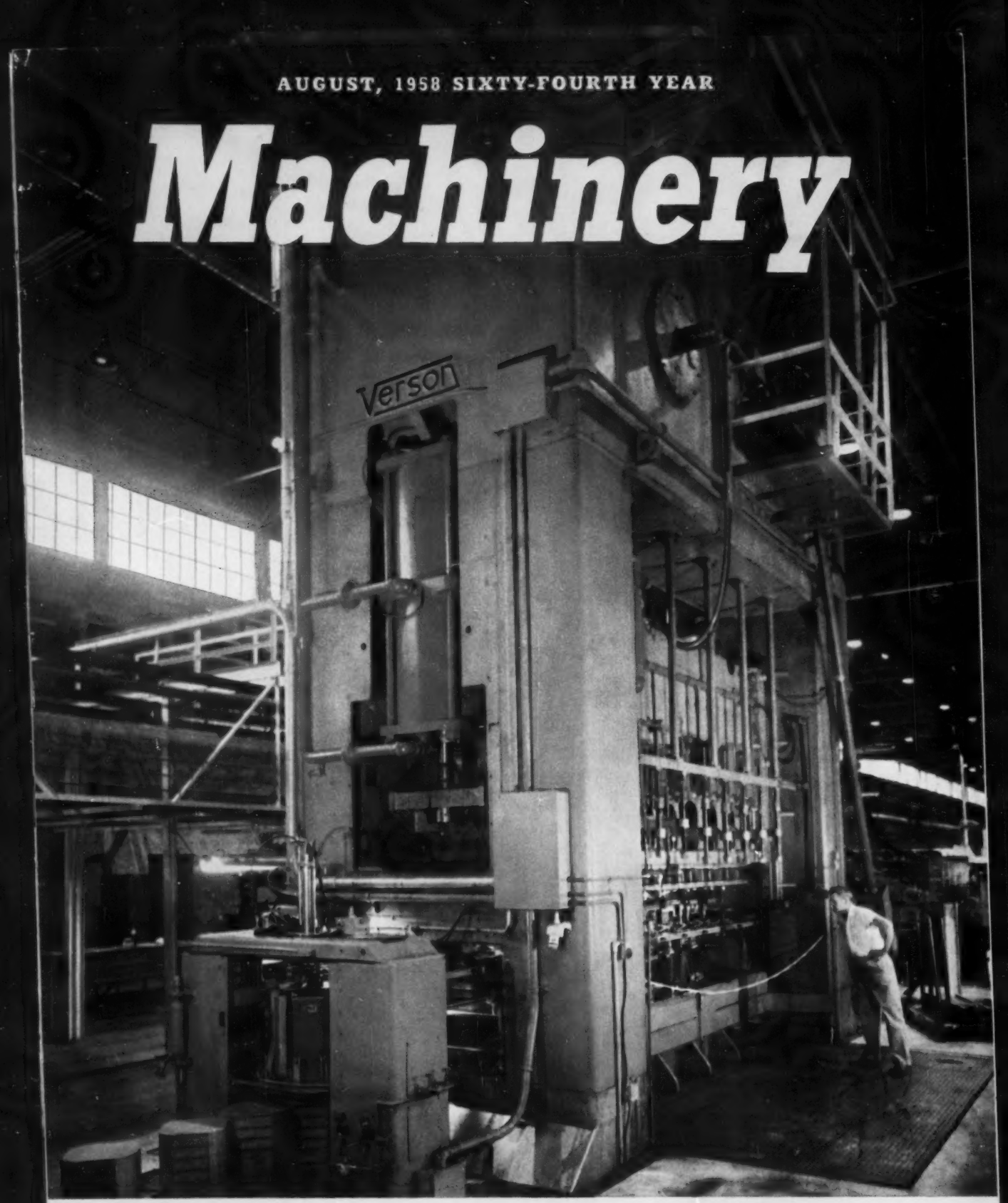
AUGUST, 1958 SIXTY-FOURTH YEAR

Machinery



it's mainly a matter of TIMING!

But how do you really KNOW when a machine has reached retirement age?

ANY machine tool could be made to last *forever* — if you kept on maintaining and repairing it forever. In fact, if you put enough money into its maintenance, you could keep it "good as new" indefinitely. But there's an economic limit to the maintenance money you can spend. And there also comes a time when "good as new" is no longer *good enough!*

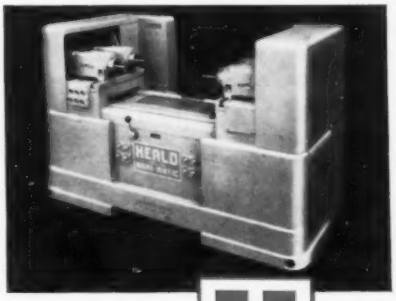
But, from the standpoint of production cost and return on investment, there *is* a mathematically predictable retirement age for any machine. Replacing it before this time is a waste of money. Retaining it *beyond* this time means a financial *loss* — often a substantial one!

Don't trust guesswork or rule-of-thumb computations to give you the right answer. There's too much money at stake.

Our sales engineers are well experienced in precise methods of replacement analysis. If you're in doubt — or would like to check your own figures — just call in your Heald engineer. He will be glad to help you. Similar obsolescence studies have effected many important savings.

For example: A diesel engine manufacturer asked for a replacement analysis on a 10-year-old boring machine, used to finish the I.D. of cam roller followers. It was found that a Model 322 Bore-Matic, like that shown at the right, would do the same job *50% faster*, with the following annual savings in operating cost:

	Old Machine	New Heald
Parts per hour	187	280
Parts per year (Req'd. Prod.)	374,000	374,000
Direct & Indirect Labor	$17,820	$9,400
Annual Maintenance	$750	$200
Annual Operating Cost	$18,570	$9,600
Annual Saving for New Machine		$8,970



YOU pay for obsolescence. Replacement pays for itself!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

HEALD

Published Monthly by
THE INDUSTRIAL PRESS

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Paris-IX°, France

Machinery

AUGUST 1958 **VOL. 64 NO. 12**

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

coarse threads tapped at lower cost

A LANDIS ALT Collapsible Tap produces coarse pitch threads in less than a minute in one pass at the Holys Manufacturing Co., Forest Park, Illinois. The workpiece is a component part for an explosion-proof rotating bronze coupling produced by Brad Harrison Co., Manufacturer Electrical Connectors, Hillside, Illinois.

JOB SPECIFICATIONS

Material: SAE 63 naval bronze casting

Thread Specifications:

Diameter	4.640"
Length	4¼"
Type	4 pitch modified square

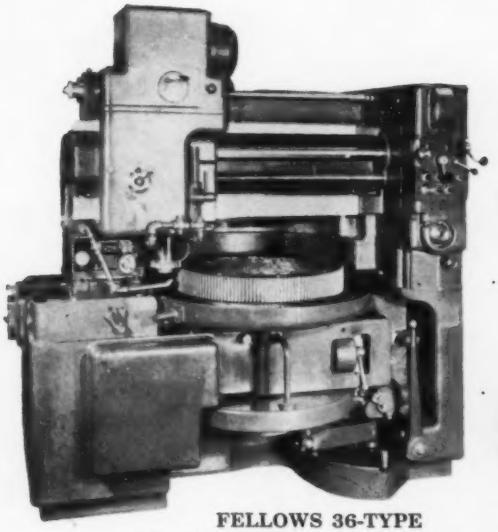
Equipment: LANDIS 5ALT Tap with a 4-½" tap head on a No. 5 Gisholt turret lathe

This installation is an example of the "money-saving" potential of LANDIS Taps. Their ability to tap large diameter coarse pitch brass or steel threads requiring heavy metal removal in one pass reduces threading time. "Built to take it" construction assures years of productive service and allows the initial investment to be spread over a long period. Detachable tap heads give wide range coverage, keeping tool investment to a minimum (the 5ALT Tap illustrated covers a range of 1⅝" to 6⅝" with 9 tap heads). Futhermore, LANDIS Precision Tap Chasers produce a maximum number of pieces between grinds with less down time for chaser resharpening. These features all contribute to reducing the actual "per piece" tapping cost.

For more complete information on other design features and the various sizes of ALT Taps for threading all diameters from 1¼" to 13¼", see your nearest LANDIS Agent or write for Bulletin G-94.

523C

Fellows Gear Shapers



FELLOWS 36-TYPE

Gears for construction equipment, textile machines, mining machinery, industrial truck transmissions, tractors, cranes and hoists are cut on this machine.

FELLOWS 120-INCH

Large, heavy duty gears for power shovels and other road construction equipment, heavy cranes, gun segments, tank turrets and winches are cut on the 120-Inch.

Modernizing cuts costs. In many plants the speed and versatility of new Fellows Gear Shapers has lowered gear production costs by more than a third and repaid the investment in just a few years.

Gear Shapers are ideal for many non-involute shapes too, such as internal and external splines, cams, clutches and nearly every other conceivable shape. Modifications to the Gear Shaper permit rapid, economical production of oval or elliptical gears. Fellows machines are available for either full- or semi-automatic operation for high speed; long-run production with a minimum of operator attention.

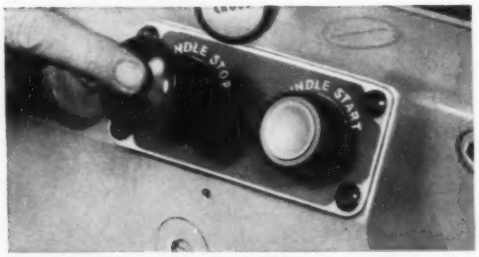
Your Fellows representative can show you where and how new machines from Fellows' Precision Line can lower your costs for small lots as well as for long production runs. Ask him for the facts.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*

Dial Type convenience and ease of control is a big factor in producing multiple operation work at low cost.

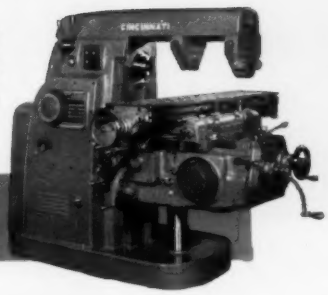
ARBOR-LOC is a big timesaver in interchanging the seven cutting tools on the table of the CINCINNATI Dial Type Milling Machine illustrated here.



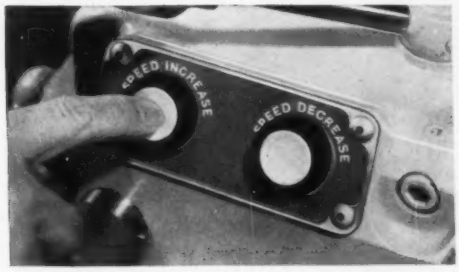
Push-button starting and stopping of spindle rotation. The operator gets quick action and automatic braking.

CINCINNATI® Knee Type Milling Machines • Bed Type Milling Machines

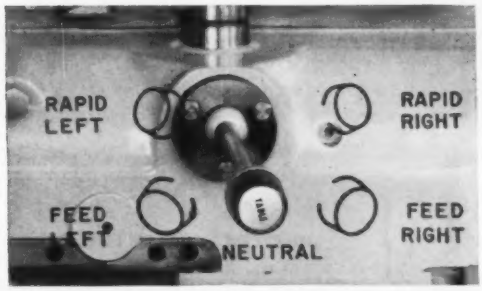
CINCINNATI Plain Dial Type Milling Machine. Also Universal and Vertical styles. Built in Nos. 2, 3 and 4 sizes, 10, 15 and 20 hp. Catalog No. M-2003.



EASY DOES IT . . . for Dial Type Operators



Push-button selection of 24 spindle speeds, throughout 16 to 1600 rpm range (18 to 1800 rpm for No. 2 Dial Types).



Five-position lever gives the operator complete one-hand control of the table (automatic cycle machines).

Power selection of 32 feeds, ranging from ⅜ to 90 ipm. Feed selection knobs located at front and rear positions.

Ask the man who runs one. He'll tell you that CINCINNATI Dial Types are easy and convenient to operate and set up, and they help him maintain high quality . . . important considerations in low cost of production. Five operator-approved features of convenience are illustrated here. Others include:

- **Lever clamping of Dynapoise overarm**
- **Automatic backlash eliminator for milling to the right or left**
- **Independent directional control levers, with palm-fitting plastic knobs**
- **Identification discs on all control lever knobs**
- **Dynapoise chatter-damping overarm, automatically damps out chatter and improves finish on the work**
- **Complete rear controls (plain and universal styles)**

Operators, foremen, maintenance engineers, all prefer CINCINNATI Dial Type Milling Machines. To get more information, just look in Sweet's Machine Tool File, or write for a copy of our new comprehensive catalog No. M-2003. And with our Replacement Analysis Manual No. M-1838 as a guide, it's easy to see the advisability of replacing old milling machines with new Dial Types. Ask for more details.

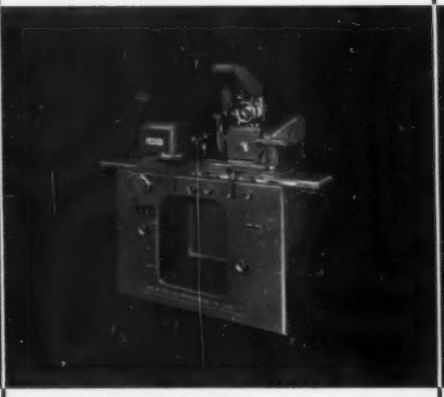
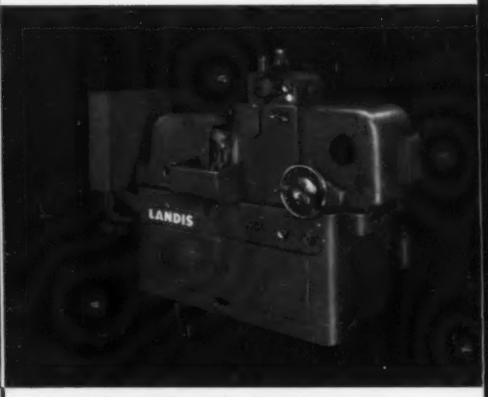
Die Sinking Machines • Cutter and Tool Grinders

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

For more information fill in page number on Inquiry Card, on page 161

Why Landis grinders with Microsphere

exclusive Microsphere spindle bearing

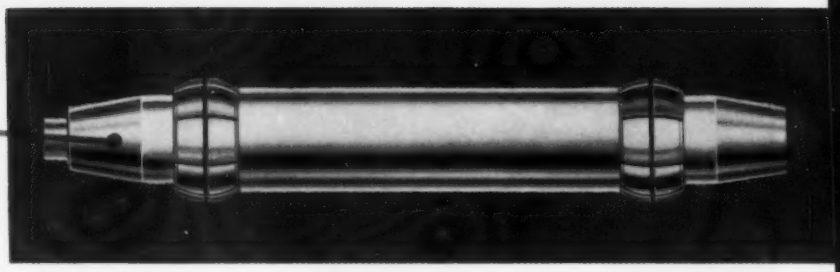
plain grinders	universal grinders	centerless grinders
		
4" to 36" swing *18" to 240" between centers* *3 to 30 hp wheel drive*	*10" to 48" swing* *28" to 120" between centers* *1½ to 7½ hp wheel drive*	*1/16" to 6" work diameter* *15 to 25 hp wheel drive*

LANDIS

precision grinders

bearings give precision *plus* production

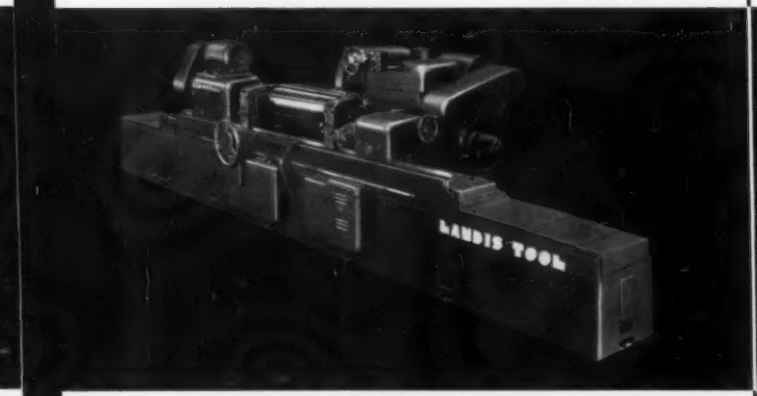
exclusive rigidized wheel spindle



Here's why Microsphere bearings *and* rigidized spindle give precision *plus* production.

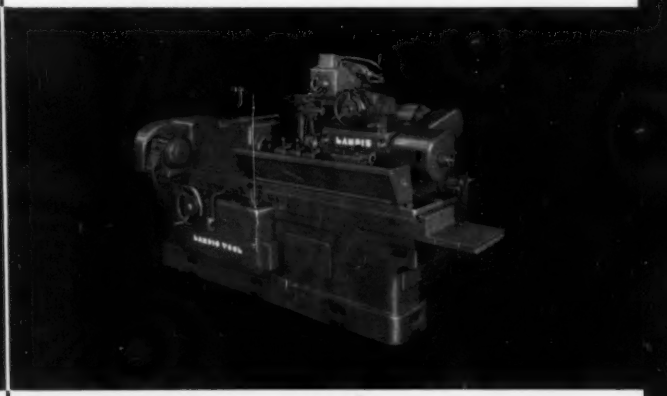
- heavy cuts to close tolerances because of bearing and spindle rigidity
- closest running clearance gives fine finishes and quick positive sparkout
- trouble-free operation with one-piece bearings and simplified construction

roll grinders



10" to 60" swing
48" to 288" between centers
5 to 40 hp wheel drive

special purpose grinders

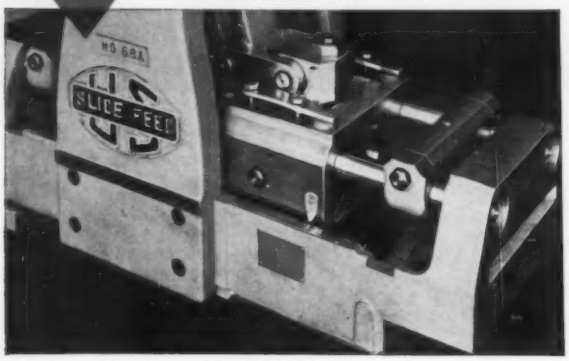


multiple wheel, concentric,
automotive types:
crank, cam, piston, valve

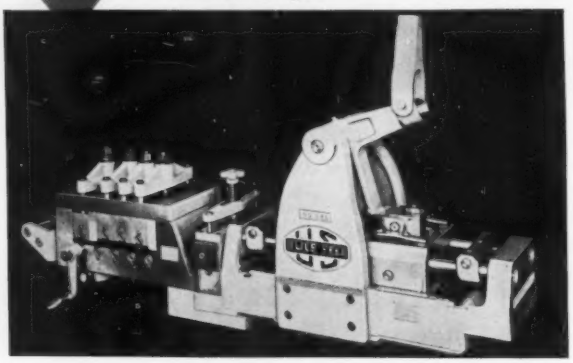
LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

Special S. F.-68A U. S. Slide Feed. Set-up for Feeding right to left on press with front to back crankshaft.

Close-up of S. F.-68A U. S. Slide Feed showing indicator on feed block and scale on body, used for rapid feed length adjustment.



S. F.-68A U. S. Slide Feed with S. S.-27 U. S. Plain Stock Straightener. Conventional arrangement for feeding from left to left.



Automatic Feeding for punch press profit!

Short run jobs—produced with long-run economy on the new U. S. SLIDE FEEDS.

NEW U. S. SLIDE FEED features reduce press room costs . . .
increase production because . . .

1. **LESS TIME NEEDED FOR CHANGEOVER.**
2. **QUICK, VISUAL FEED LENGTH SETTING.**
3. **SIMPLE STOCK THICKNESS ADJUSTMENT.**
4. **UNSURPASSED ACCURACY - WITH OR WITHOUT PILOTS.**
5. **MORE POSITIVE CHECK.**

The U. S. Slide Feed, Model S. F.-68A, illustrated here, feeds stock widths up to 6" and has a maximum feed length stroke of 8". Available for immediate delivery.

For complete information about the new U. S. Slide Feeds, write for Bulletin No. 101. Information concerning other U. S. Press Room equipment is yours by asking for Bulletin No. 85M.

PRODUCTS

U. S. TOOL COMPANY, INC.

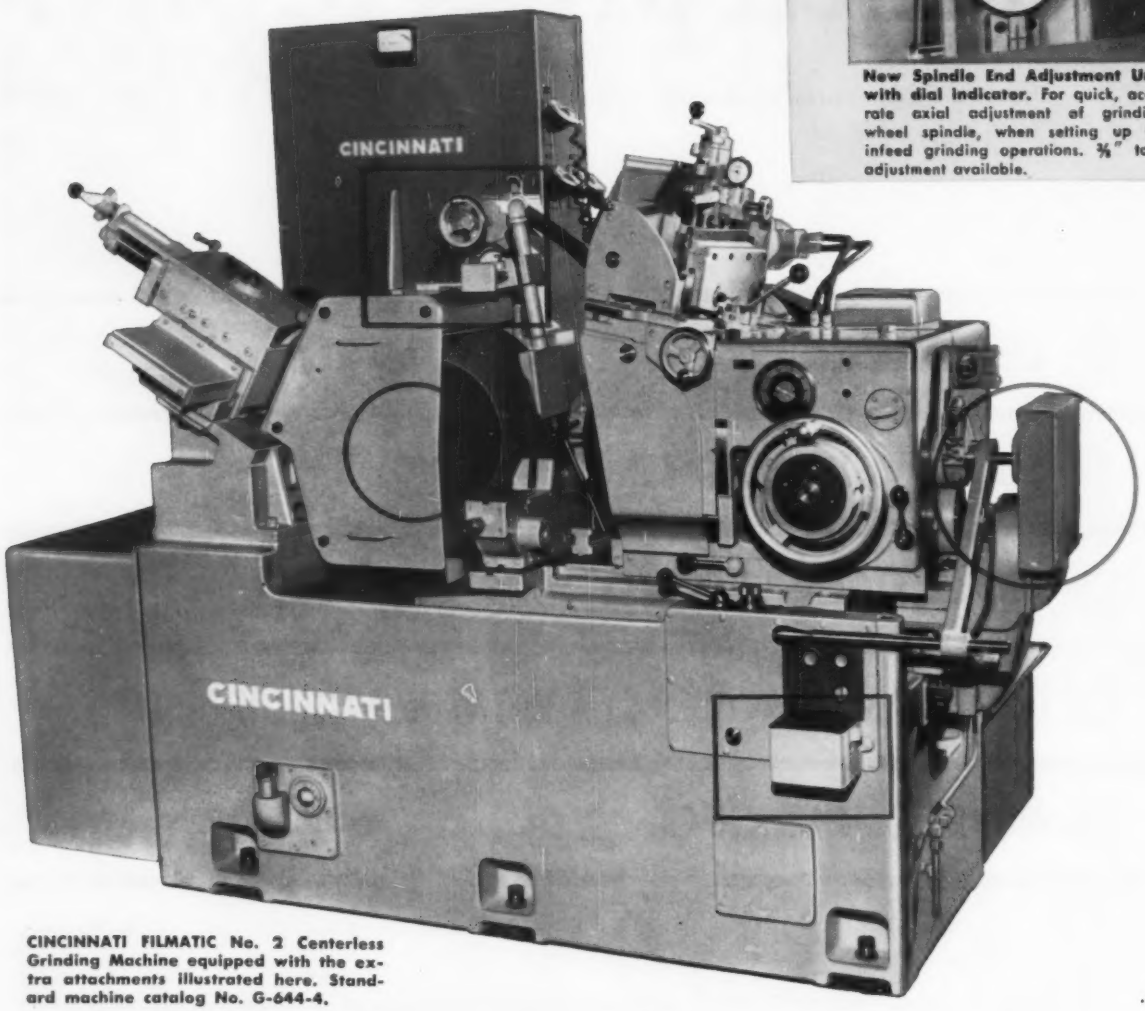
AMPERE *(EAST ORANGE)* NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

For more information fill in page number on Inquiry Card, on page 161

LOOK WHAT'S NEW

New Spindle End Adjustment Unit with dial indicator. For quick, accurate axial adjustment of grinding wheel spindle, when setting up for infeed grinding operations. ⅜" total adjustment available.

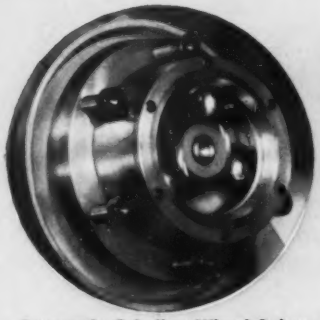


CINCINNATI FILMATIC No. 2 Centerless Grinding Machine equipped with the extra attachments illustrated here. Standard machine catalog No. G-644-4.

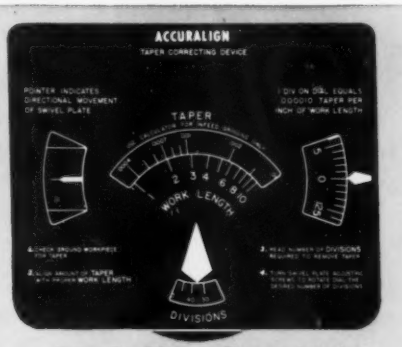
CINCINNATI®

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES •

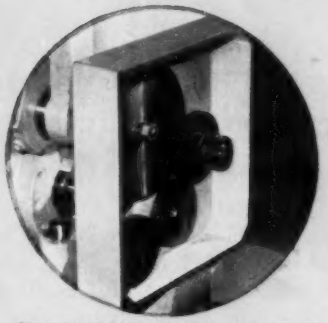
in Low-Cost Centerless Grinding



Automatic Grinding Wheel Balancing . . . an exclusive feature. Freely rotating steel balls automatically balance the wheel mount when unclamped. Perfect balance is attained in a few seconds. Ask for demonstration.



New Precision Indicator Attachment for taper correction. Provides a visual check on the amount of regulating wheel unit swivel adjustment, measured in increments of .000010" per inch. Top of unit shown here.



New Vari-Pitch Unit for hand infeed grinding. A simple change gear arrangement gives the operator a choice of three throat openings for maximum safety and convenience in loading infeed work.

. . . New Types of Equipment now available for CINCINNATI FILMATIC Nos. 2 and 3

In centerless grinding, the newest is CINCINNATI, and every new feature contributes to the end result of reducing precision grinding costs. Just take a look at the new accessory equipment illustrated here. It's easy to see how useful these attachments are in saving setup time; improving quality; facilitating operation . . . in short, *reducing costs*. Other equipment in which you will be interested includes:

New Crush Truing Unit for production form grinding. Incorporates several exclusive features. (Separate literature available, No. G-706.)

New Bar Grinding Fixtures: type "V" for bars 3, 6 and 9 ft. long; "C" for bars up to 24 ft. long.

New Work Blade Dial Indicator for quickly and accurately aligning work rest blade.

Push-Button Automatic Grinding Wheel Truing.

Automatic Gap Eliminator (with Automatic Electro-Hydraulic Infeed) for production infeed work: greatly reduces time spent in "grinding air."

In addition to the many advantages offered by these new CINCINNATI Centerless Attachments, the machine itself will give you far superior performance because of FILMATIC grinding wheel spindle bearings . . . antifriction infeed slide . . . infinitely variable regulating wheel speeds . . . quality controlled castings. Cincinnati is tops for your replacement program; for producing your new products; for engineering service. Preliminary information in Sweet's Machine Tool File.

CINCINNATI

MACHINES • MICRO-CENTRIC GRINDING MACHINES
CHUCKING GRINDERS • CENTERLESS LAPPING MACHINES

Grinding Machine Division
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

For more information fill in page number on Inquiry Card, on page 161

The big 3 inch

G&L 300-T table-type horizontal boring, drilling and milling machine

Here's America's most versatile 3" dia. spindle horizontal machine! With truly exceptional efficiency it bores, mills, drills or taps. Generous bearing surfaces provide maximum rigidity to give the 300-T outstanding ability to consistently produce excellent finishes with precision accuracy *through the entire machining range.* For further facts, call your nearest G&L representative or write direct.

FEATURES THAT CAN PRODUCE MORE PROFIT FOR YOUR SHOP:

- **45 spindle speeds, 36 spindle feeds** provide exact choice for any type tooling or work material.
- **Full length precision scales and verniers** easily read to .001" for headstock, table, saddle and end support.
- **Hardened bed and saddle ways** provide longer life to maintain higher machining accuracy.
- **Rotary selectors and rotary reading dials** for fast, accurate selection of feeds and speeds.
- **23 milling feeds.** Ideal for a broad variety of milling.
- **Independent operation;** all units operate independently in either direction, simplifying machine handling and control.
- **Automatic electric positioning device** accurately controls distances between machined holes. Makes possible positive machine settings for boring operations repetitive to .0002". Ends pre-layout and manual adjustments. (*)
- **Improved measuring device** for headstock, table and saddle provides extreme accuracy in positioning with readings to .0001". (*)
- **Exclusive G&L "Lubri-Cool" system** assures accurate operation under any temperature condition. (*)

(*) Optional equipment

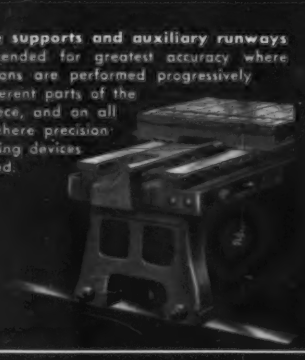
G&L *and* HYPRO DIVISION

GIDDINGS & LEWIS MACHINE TOOL CO.

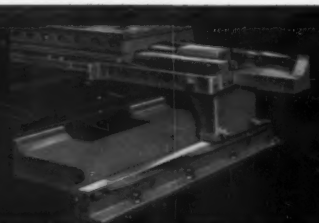
FOND DU LAC, WISCONSIN

G-94

Builders of the world's finest heavy-duty Table, Floor and Planer Types Horizontal Boring, Drilling and Milling Machines; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring and Turning Mills; Spar and Skin Milling Machines; VARIAX Milling Machines and NUMERICORD-numerical continuous path tape controls.



Saddle supports and auxiliary runways recommended for greatest accuracy where operations are performed progressively on different parts of the workpiece, and on all work where precision measuring devices are used.



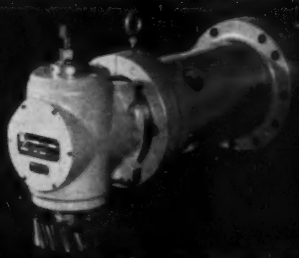
Over-the-floor type auxiliary runways provide complete location flexibility. Especially designed to meet problems created by foundation limitations.

Built-in rotary tables eliminate multiple work setups. Two sizes: 30" x 36" and 36" x 42"

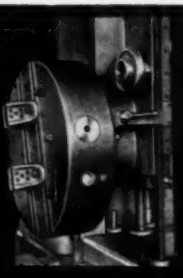
FAST, ACCURATE, VERSATILE, PRODUCTIVE

G&L Model 300-T table-type Horizontal with automatic electric positioning device completes 47 distinct operations in less than three hours on this complex gear case housing. It bores, drills, mills, counterbores and reams. The 300 Series machines are available in two models with a wide range of specifications: Standard Model 300-T and Model 300-RT machine with a built-in rotary table.

Combination plain, hand and power feed rotary table — fast, accurate hand or power indexing. Available with round, square or rectangular platens in various sizes.



Angular milling attachment operates at right angles to machine spindle. Unusual flexibility for machining hard-to-reach surfaces.



Continuous feed facing and boring heads used separately or in combination with other attachments or accessories for turning, facing, threading, back facing, grooving, etc. Telescopic right angle and facing tool holders, and high speed grinder are also available.

The right Tap for every job—and every one with BALANCED ACTION

Whether it's a standard tap or a tap for special application, every size and type in Winter's complete line gives you a higher production potential because of famous Winter quality. Only Winter Taps perform with Balanced Action—your guarantee of high hole accuracy, trouble-free operation and long tool life.

GAGES AND DIES

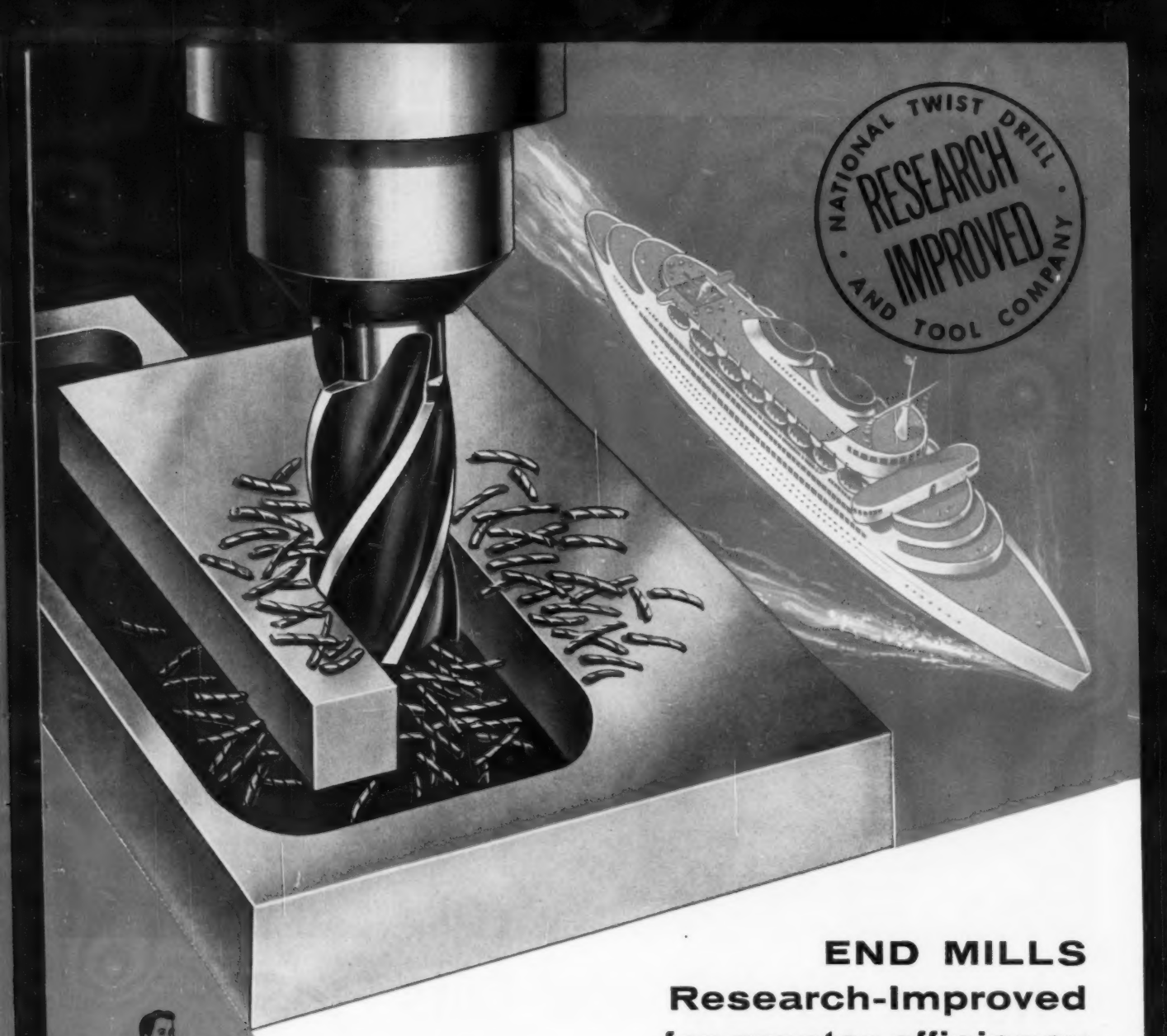
The same excellence in design and construction can be yours in Winter Plug and Ring Gages, thread or plain; Adjustable and Solid Thread Dies.

CALL YOUR DISTRIBUTOR
for standard and special WINTER Balanced Action Taps, Dies, and Gages.

WINTER

WINTER BROTHERS COMPANY
Rochester, Michigan, U.S.A.

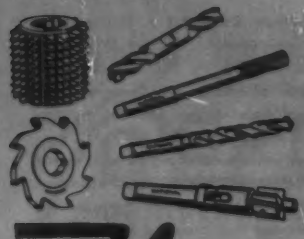
Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles •
Division of National Twist Drill & Tool Co.



END MILLS
Research-Improved for greater efficiency

"Helex" End Mills, one of the most versatile and efficient series in the National line, are Research-Improved for higher cutting speeds and higher feeds. Available for soft or hard metals, in a variety of sizes and styles—high speed steel or carbide. In toolroom or production operation, National End Mills give you precision milling of slots, keyways and pockets—*fast* . . . You profit by National's continuing search for better ways of cutting metals.

CALL YOUR DISTRIBUTOR for NATIONAL twist drills, reamers, counterbores, milling cutters, end mills, hobs, carbide and special tools.

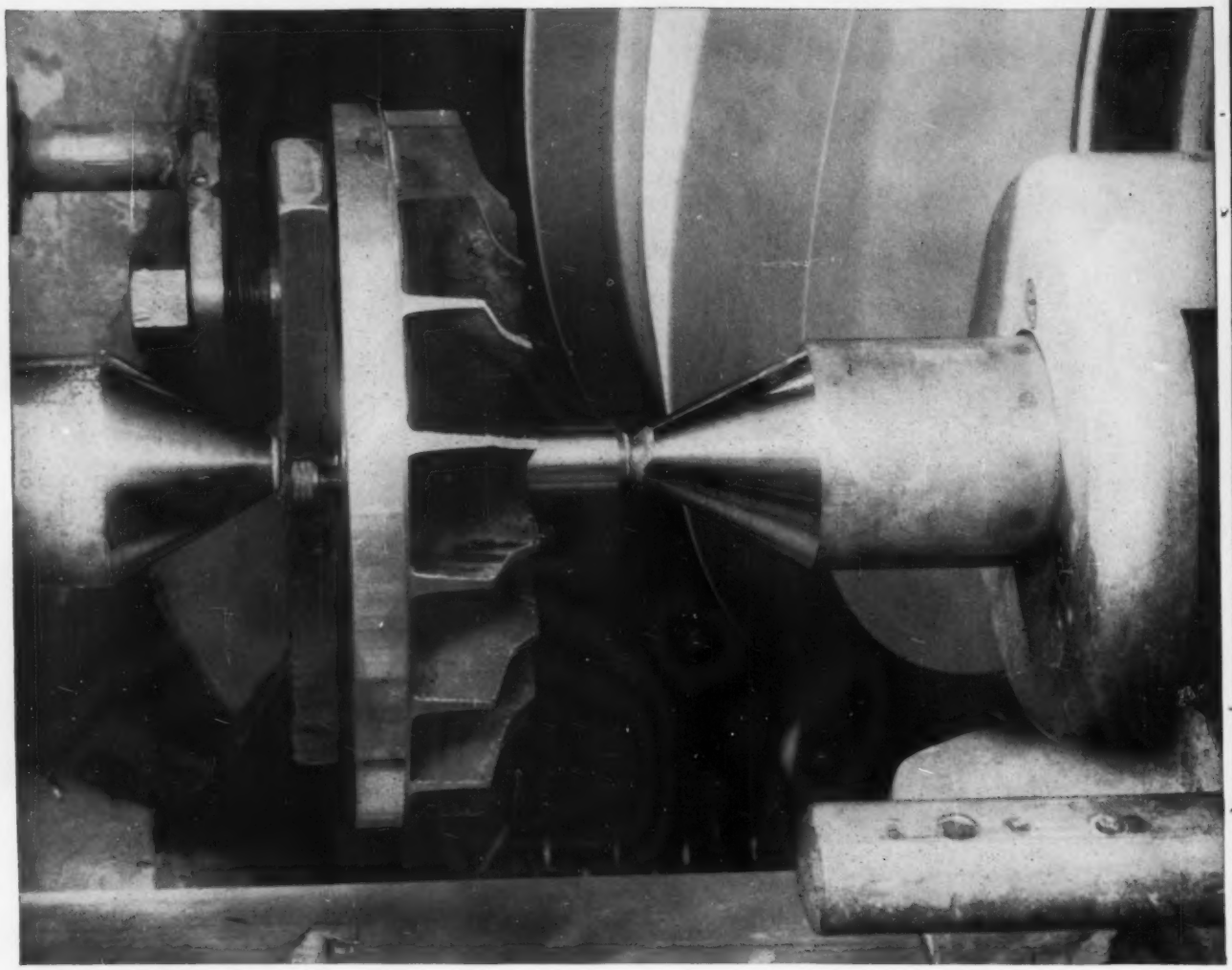


NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH. U.S.A.

National

NATIONAL TWIST DRILL AND TOOL COMPANY **Rochester, Michigan, U.S.A.**

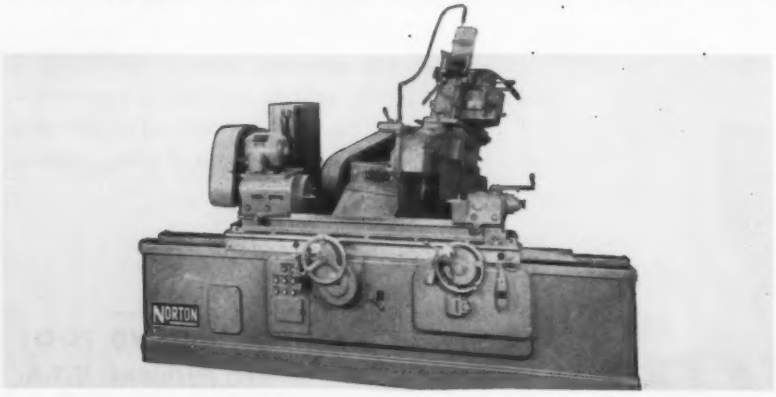
Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles



Norton CV-4 Grinder Cuts Production Time in Half

...at large west coast engine component plant

Saves on Grinding Operations



One Operation Does It! A Norton Type CV-4 10" Semiautomatic Angular Wheelslide Grinder was installed by the AiResearch Industrial Division of the Garrett Corporation to precision grind diesel engine turbocharger turbine wheels to increments as fine as .0005". Previous grinders performed 4 separate grinding operations. The Norton CV-4 increased efficiency and reduced grinding to a single operation. As a result, production time dropped from 19½ to 8½ minutes, for each turbocharger . . . a 56% reduction!

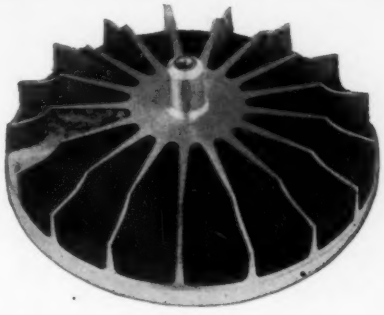
"Norton Type CV-4 Semiautomatic Angular Wheelslide Grinders combine shoulder and diameter grinding to give big operation economy."

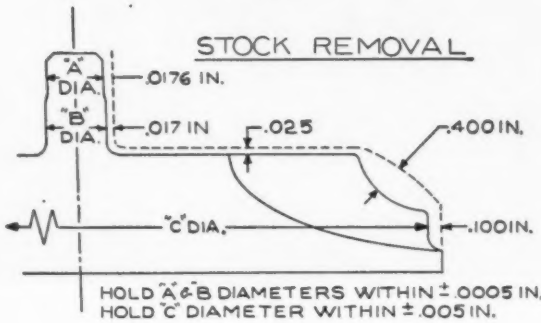
Combining several precision grinding jobs and doing them faster and better is routine performance for this cylindrical grinder. For example, it leaves a concentric grain pattern on shoulders, improving the sealing quality and appearance. The CV-4 gives the "Touch of Gold" to your production by reducing effort, time and costs, and increasing your grinding profits.

- Automatic grinding cycle saves operator's time and effort and makes possible his tending more than one machine. Once the cycle starting lever is pulled the machine takes over and automatically grinds to size.
- Automatic wheel head mounted truing device provides pushbutton control of straight, stepped or formed wheel truing—eliminates need of skill and reduces wheel cost per piece ground.
- Ramped outlet from coolant tank speeds clean-out . . . pumps and motors all outside and easy to reach . . . electrical controls all grouped in raised enclosure . . . base ways protected by steel tape guards, requiring no additional floor space . . . hydraulic oil and ways lubricant carried in outside reservoirs with large gauge-glasses.

Type CV-4's can do the work of two or more ordinary cylindrical grinders in your plant. They are available with hand table or hydraulic power table traverse in 10″ and 14″ sizes, and in work lengths of 18″, 36″, 48″ or 72″. *Improve your competitive position and increase your grinding profits* — replace obsolete grinding equipment with these modern machines. Ask your Norton Representative for Catalog No. 1658-2, or write us direct. Remember, only Norton offers you such long experience in both grinding machines and grinding wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. In Canada: J. H. Ryder Machinery Co. Ltd., Toronto 5.

Set-And-Forget Automatic Operation Saves Labor . . . requires minimum of manual operation . . . loading, locating, starting cycle and unloading. Thus valuable labor is released for other work, yet precision is automatically maintained. For stock removal see diagram below.





To Economize, Modernize with **NEW**

NORTON

GRINDERS and LAPPERS

Making better products...to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

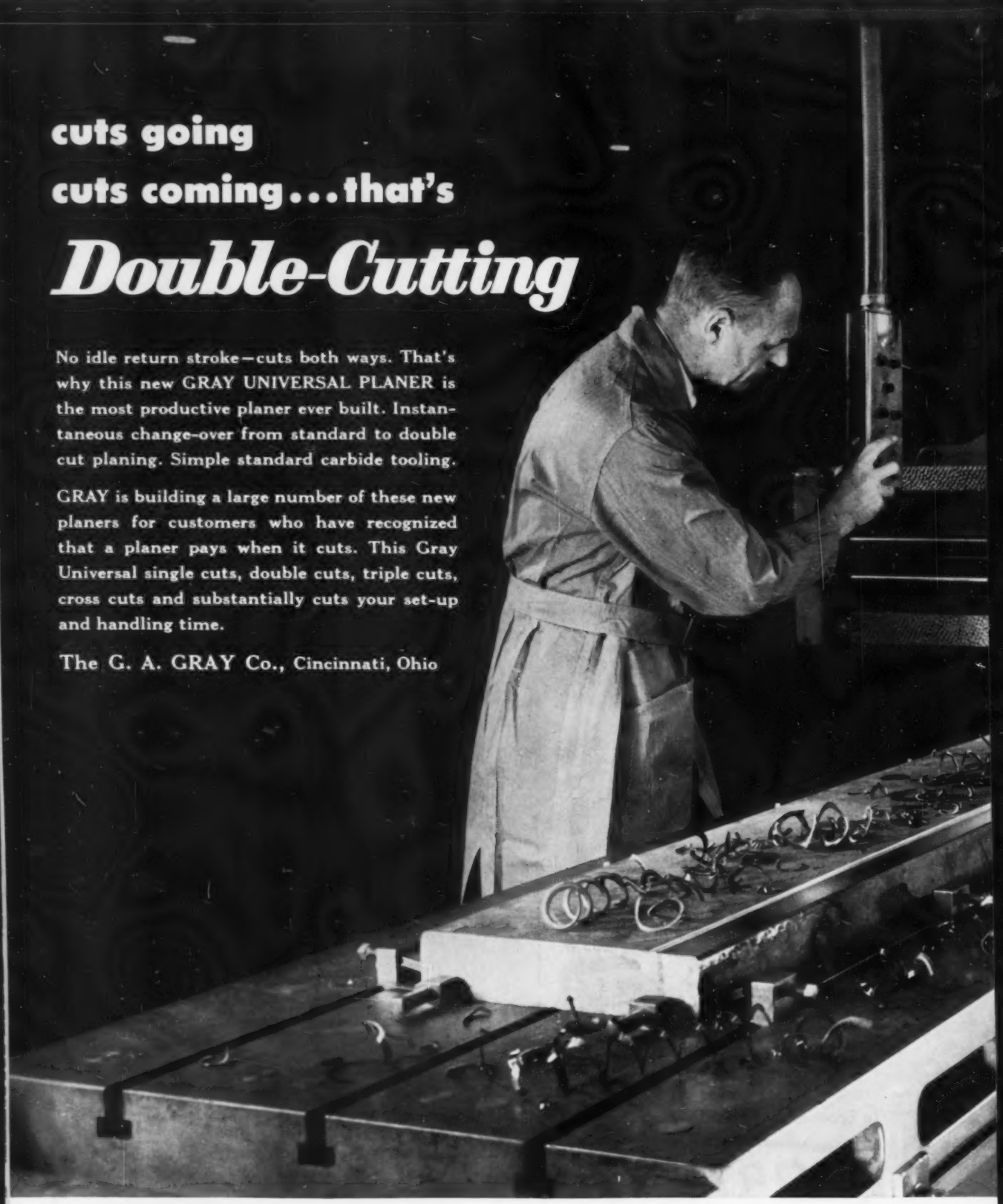
For more information fill in page number on Inquiry Card, on page 161

cuts going
cuts coming...that's
Double-Cutting

No idle return stroke—cuts both ways. That's why this new GRAY UNIVERSAL PLANER is the most productive planer ever built. Instantaneous change-over from standard to double cut planing. Simple standard carbide tooling.

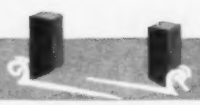
GRAY is building a large number of these new planers for customers who have recognized that a planer pays when it cuts. This Gray Universal single cuts, double cuts, triple cuts, cross cuts and substantially cuts your set-up and handling time.

The G. A. GRAY Co., Cincinnati, Ohio



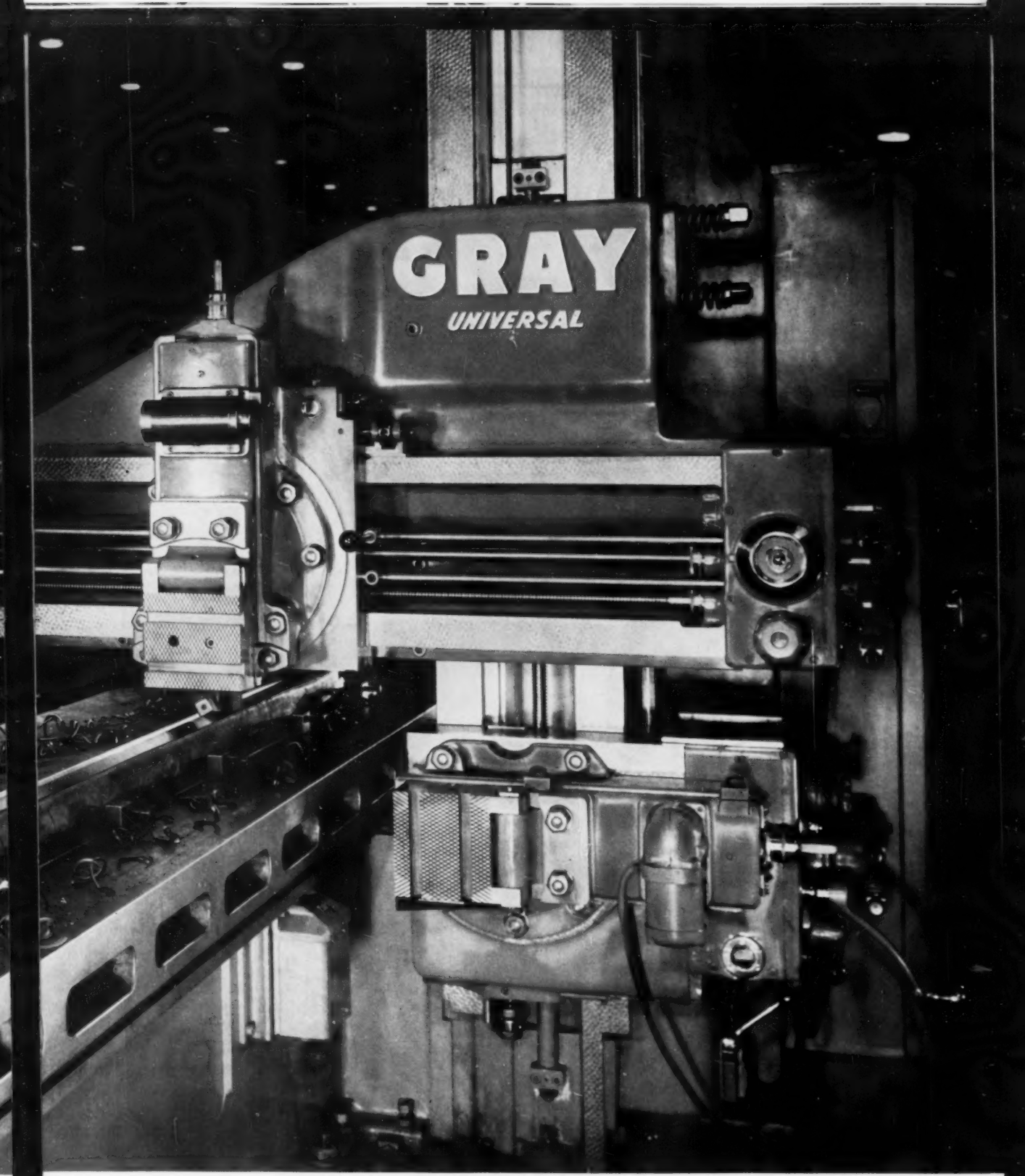
heavy-duty planing

The Gray Universal is the world's most powerful planer available for conventional planing. Its rigidity and speed are ideally suited for modern carbide cutting.



double cut planing

The flick of a lever, the touch of a button permits double cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.



triple cut planing

Rough and rough-finish plane at the same time. Rough by double cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.

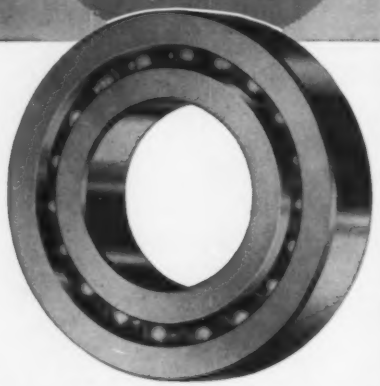
cross planing

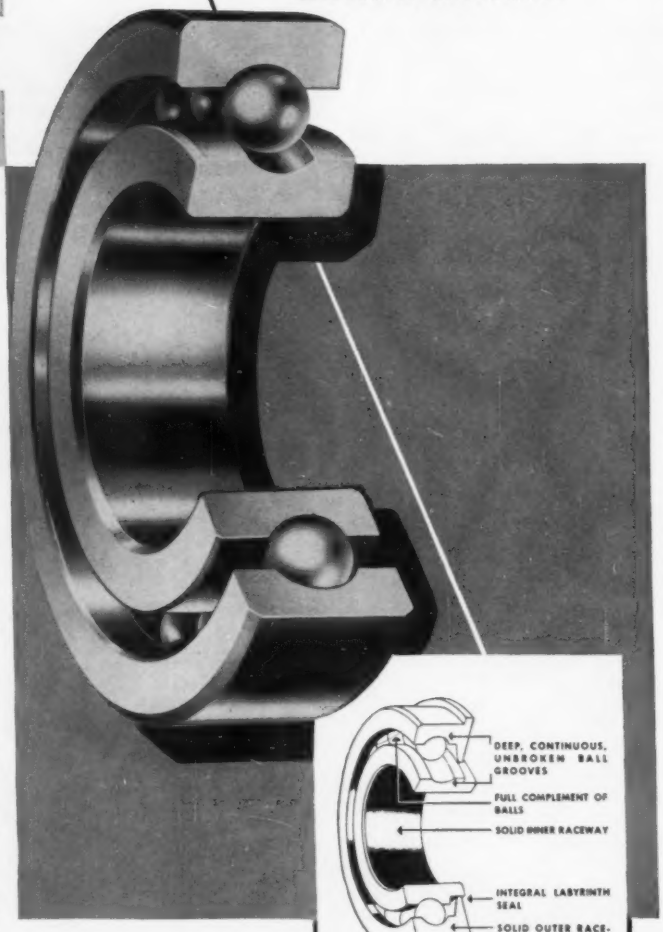
Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.

The **NICE** *Way to Lower Cost...*

Premium Performance *at Lower Cost*

with **BALL BEARINGS** *of Revolutionary New Construction!*





NICE now offers the revolutionary new UNIBAL® . . . a low cost ball bearing of superior quality and greater durability, suitable for requirements ranging from the commercial field to many precision applications heretofore using conventional ground bearings. Its simplified construction and assembly method incorporates a new concept in design.* There are no loading slots . . . no split raceways, yet there is a full complement of balls.

Deep, unbroken ball grooves, with closer tolerances and improved finish, provide quiet, smoother operation, with maximum capacity for radial and thrust loads.

UNIBAL Ball Bearings can be furnished in single row, double row, flanged or snap ring types in a wide range of widths and diameters, and the novel construction permits a variety of shield and seal devices.

Your Inquiries Invited.

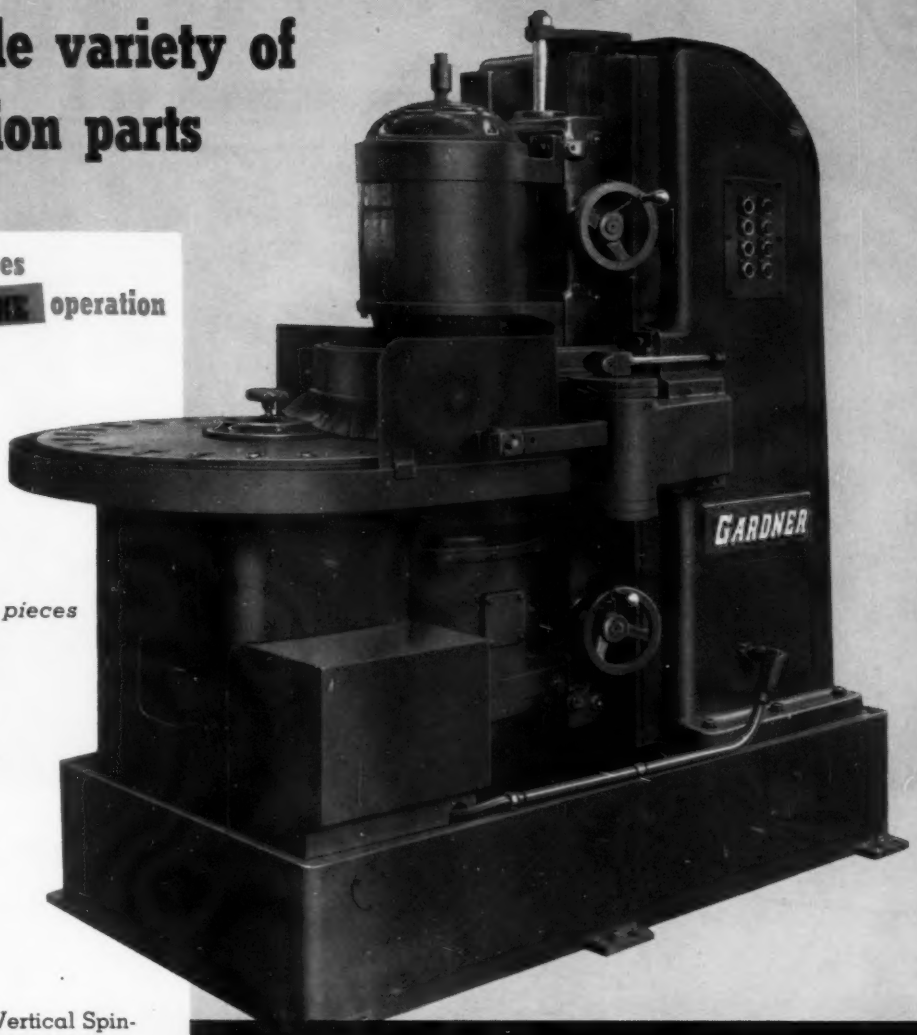
*Patent Applied For.

NICE®

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 161

Gardner 2V18 demonstrates versatility in grinding wide variety of small precision parts

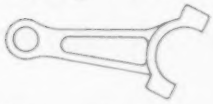


TWO parallel surfaces precision ground in **ONE** operation

Counter pinion
2400 per hour

Upper and lower pole pieces
250 per hour

Watch disc
4000 per hour



Connecting rod
900 per hour

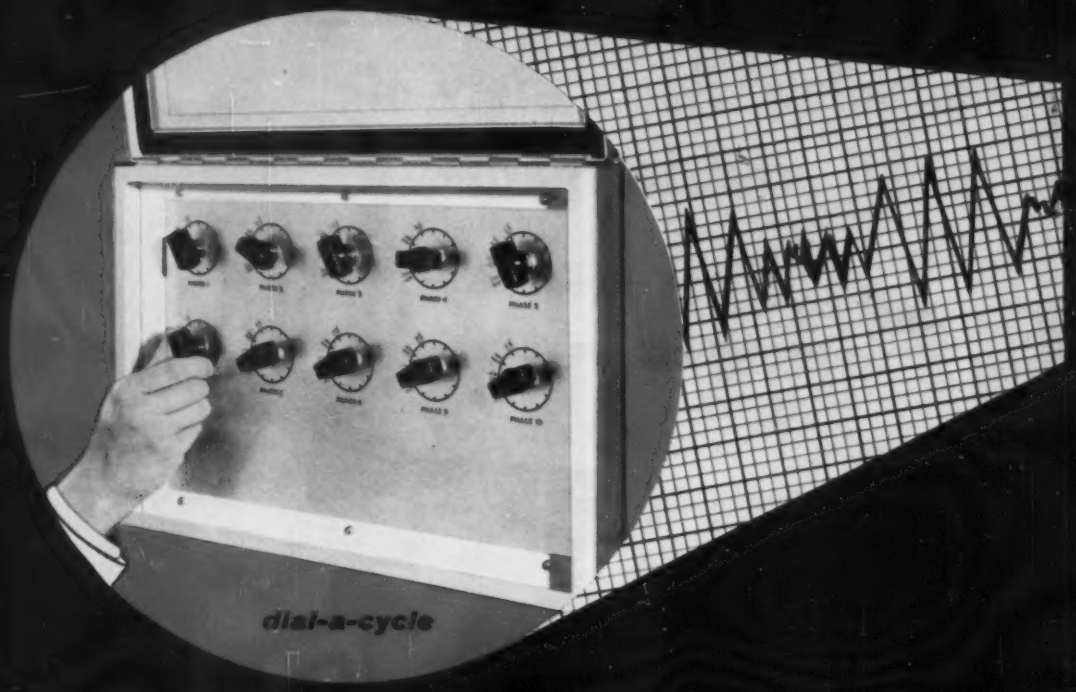
Gardner 2V18 Double Vertical Spindle Grinders lower costs with fast, accurate grinding. Interchangeable work carriers for parts of many shapes, assure profitable, flexible operation. Write for latest catalog.

Rotary work carrier assures high production grinding of both sides of small connecting rods.

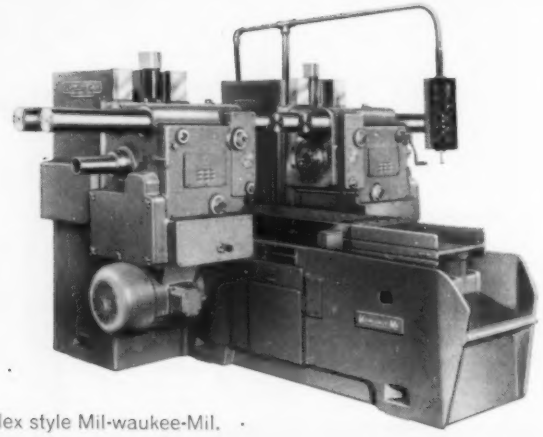
GARDNER

precision disc grinders

BELOIT, WISCONSIN



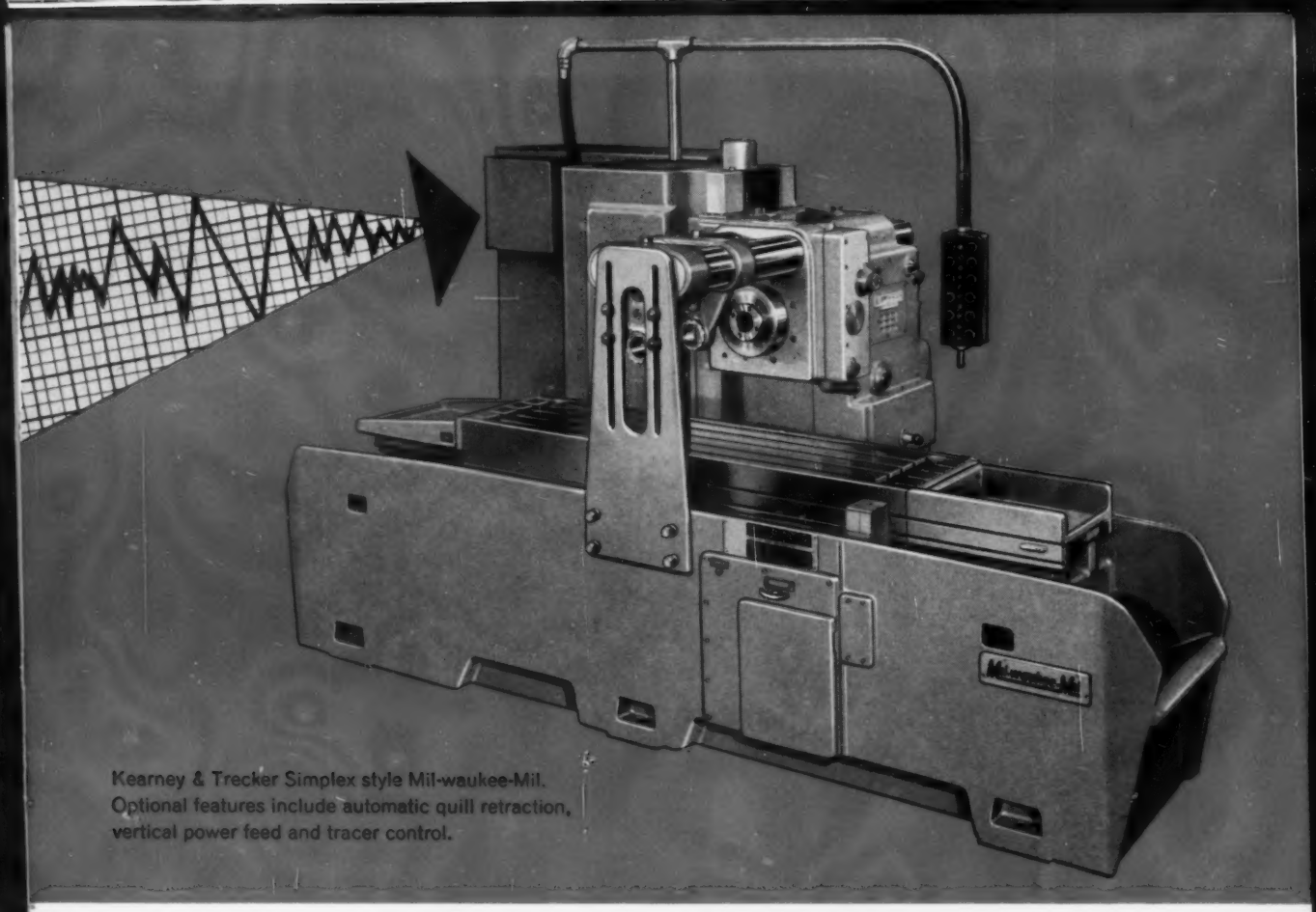
first ***dial*** *your results from the blueprint* ...



Kearney & Trecker Duplex style Mil-waukee-Mil.

Designers and Builders of Precision and Production Machine Tools Since 1898

KEARNEY & TRECKER MILWAUKEE ®



Kearney & Trecker Simplex style Mil-waukee-Mil. Optional features include automatic quill retraction, vertical power feed and tracer control.

then get programmed production ***automatically***
with the NEW ***Kearney & Trecker***

Mil-waukee-Mil® BED TYPE
PRODUCTION MILLING MACHINE

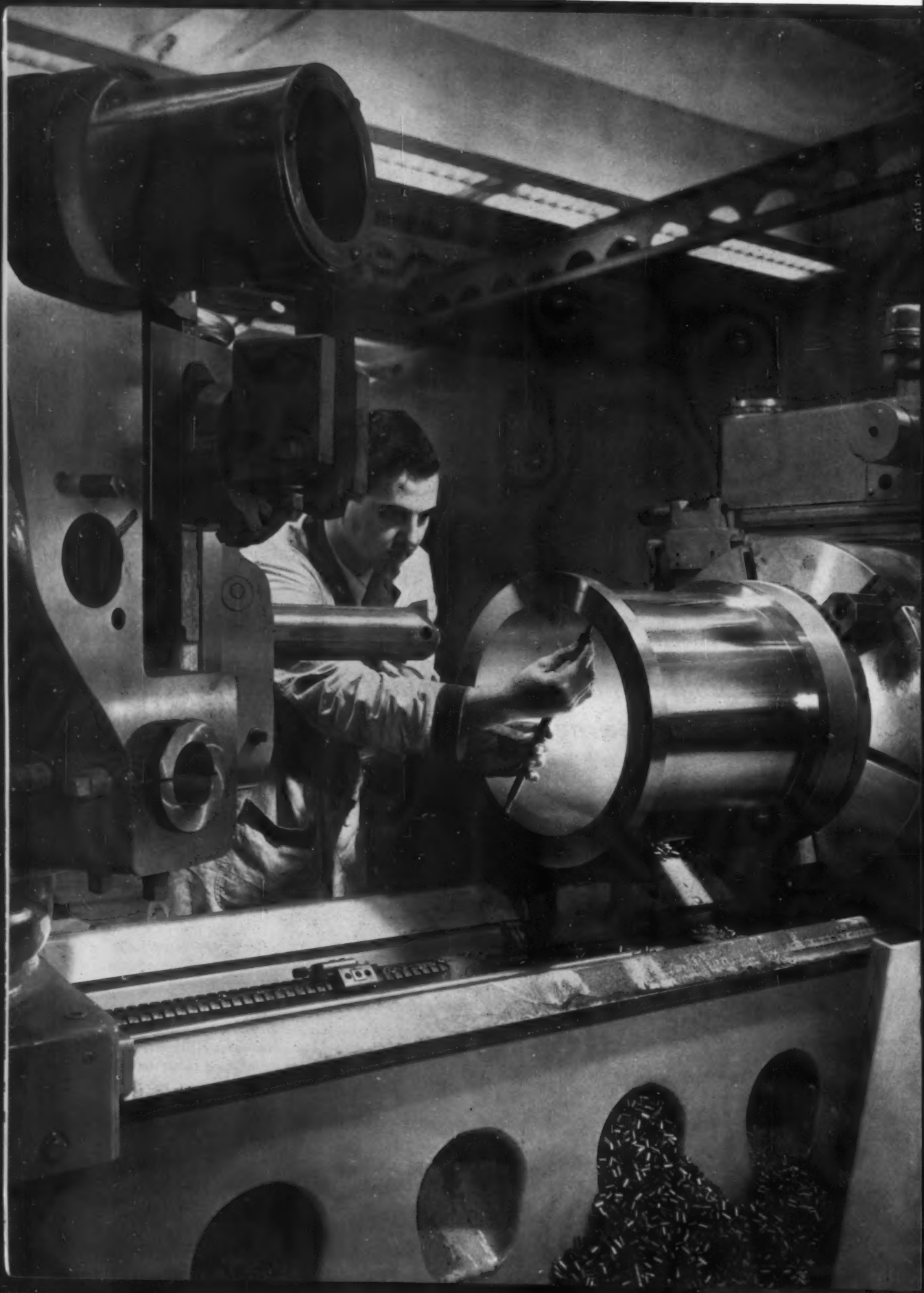
- ***dial-a-cycle*** **panel programs and controls each and every machine function . . . automatically!**
- **Interrupt or resume cycles at any time without returning to "start" position!**
- **Change from *dial-a-cycle* automatic control to manual with the flip of a switch!**
- **Choose from 72 standard models . . . Simplex and Duplex . . . 7½ to 30 hp.**

Fast, pre-phased setups slash idle cutter time — dramatically boost finished workpiece production. Do it on this remarkable new Kearney & Trecker Mil-waukee-Mil programmed production milling machine.

Operator simply dial-programs machine function into the ***dial-a-cycle*** control panel. No guesswork! He merely reads workpiece blueprint and establishes machining sequence with successive phase-switch dials.

Free Bulletin MM-58 —

Kearney & Trecker Corp., 6788 West National Ave., Milwaukee 14, Wisconsin.



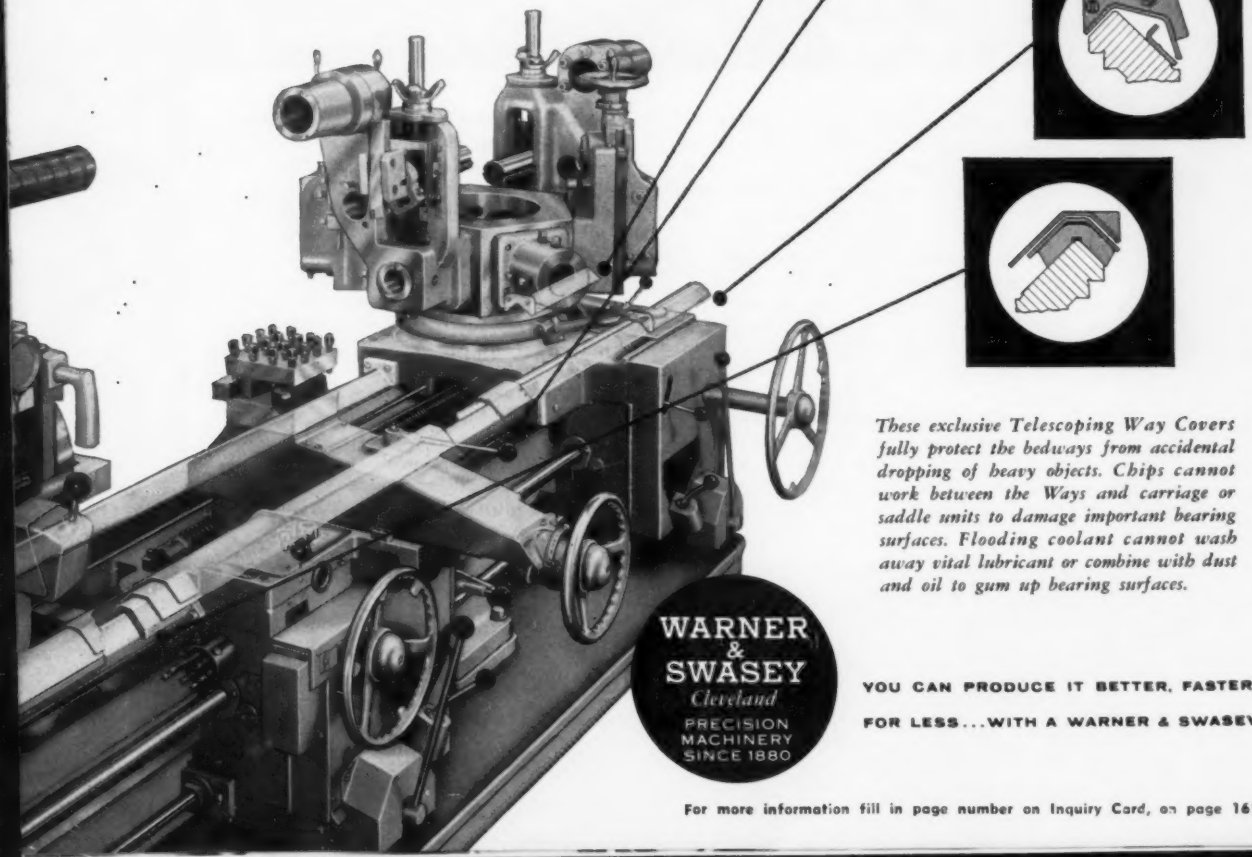
VEE-WAY ACCURACY and EASE OF OPERATION

preserved by Warner & Swasey's telescoping way covers

Regardless of carriage or saddle positions on the bed, Warner & Swasey's patented Telescoping Way Covers provide complete bedway protection. Tools, gritty materials, cutting fluids, even heavy workpieces can fall on the Way Covers but the accuracy and free-sliding smoothness of Warner & Swasey's exclusive self-guiding Vee-Ways are fully protected throughout years of hard use . . . and with a minimum of maintenance. As a result, dependable, close-tolerance performance is easy to maintain without fighting or pampering the machine.

With Warner & Swasey Saddle Type Turret Lathes, operators stand closer and more comfortably to their work. That's because strength and rigidity of the bedways are achieved through scientific cross-rib construction instead of by mere mass and width of the bed. They report their Warner & Swaseys are easier to handle because all movable units slide on well-lubricated bearing surfaces—enclosed and protected at all times by the patented Telescoping Way Covers.

When operators like the equipment on which they work—production increases. So, why not let our Field Representative show you all the operator advantages designed into Warner & Swasey Turret Lathes? It can save you money.

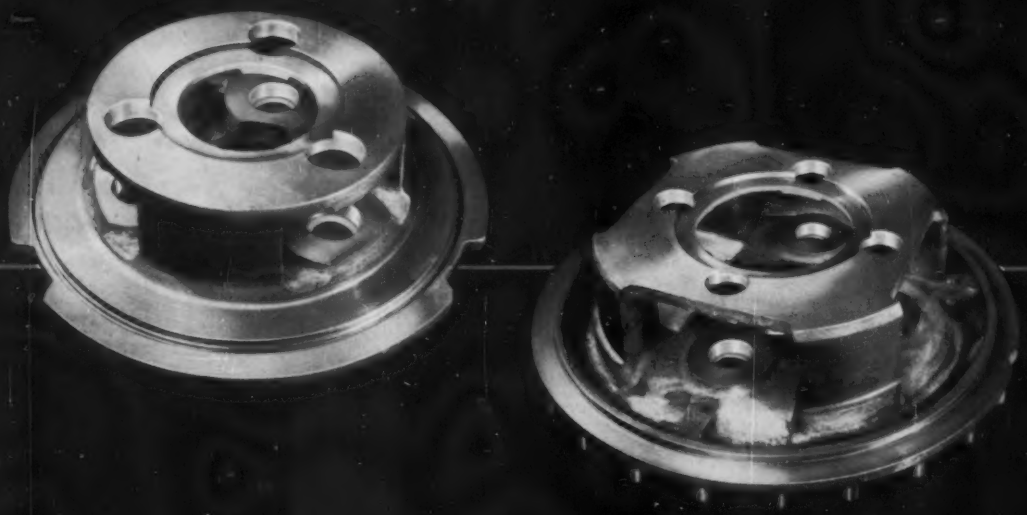


These exclusive Telescoping Way Covers fully protect the bedways from accidental dropping of heavy objects. Chips cannot work between the Ways and carriage or saddle units to damage important bearing surfaces. Flooding coolant cannot wash away vital lubricant or combine with dust and oil to gum up bearing surfaces.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

For more information fill in page number on Inquiry Card, on page 161

Precision Bores Nine Different Planetary Drive Housings



This new Cross dial machine bores the planet pinion holes in planetary drive housings. Production of parts with three pinions is seven per hour and with four pinions five per hour at 100% efficiency. Changeover from one part to the other can be accomplished quickly and easily.

Housings are manually loaded into the fixture in the center of the index table. The automatic cycle begins when the cutter head moves horizontally to bring the first spindle into position to rough bore the pin holes. Spacing is established by the index table, which positions the part for boring one hole at a time. The cutter head then indexes the second spindle into position and the holes are semi-finish bored. Finally, the third spindle indexes into position for finish boring. After all cuts are completed on each hole, the head moves horizontally away from the work piece to complete the automatic cycle.

Roughing and semi-finishing operations are performed with multiple blade cutters, while the precision finishing operation is accomplished with a single point tool.

Other features include: complete interchangeability of all standard and special parts, construction to JIC Standards, hardened and ground ways, hydraulic feed and rapid traverse, and automatic lubrication.

Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN


Another Special by Cross
ROSS
CROSS

LOOKING FOR MORE FROM

For steelcutting . . . trim costs with Carboloy® Extra-Performance Grades 330, 350, and 370, and low-cost, General-Purpose Carboloy 78 and 78B carbides

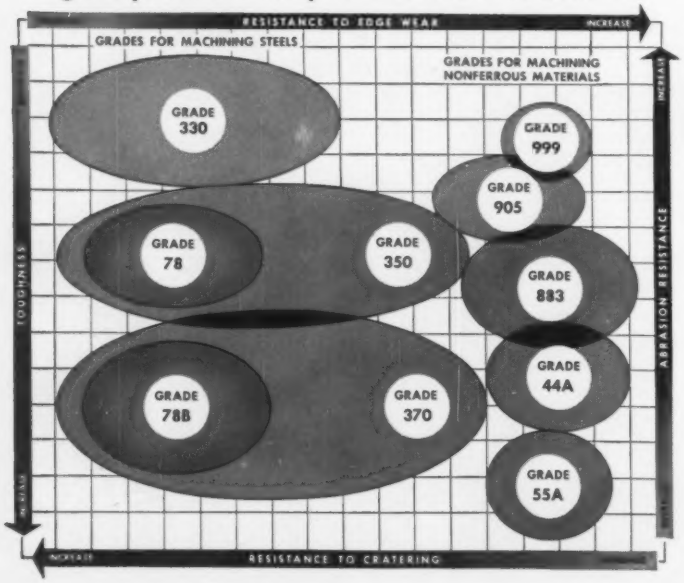
Some steelcutting jobs call for extra-tough, extra-performance carbides. Others can only be handled profitably with low-cost, general-purpose carbides. That's why we make them *both*.

Where you need increased machine productivity and have long production runs to keep cost-per-piece low—use Carboloy Extra-Performance Series 300 carbides. Their added strength and stamina handle jobs ranging from heavy roughing to high-speed finishing . . . at a unit cost and rate no "premium" carbide on the market can beat.

But, for general-purpose steelcutting jobs that don't require the Extra-Performance carbides, use Carboloy Grades 78 and 78B. Their top-notch performance, at low initial tool cost, will keep your machines operating profitably.

Chances are, your plant should be using *both* grades. Your local Authorized Distributor of Carboloy cemented carbides can deliver tools, blanks and inserts you need . . . in a hurry.

This complete team of Carboloy cemented carbides gives you more for your carbide tool dollar!



YOUR CARBIDE TOOL DOLLAR?

For nonferrous materials . . . boost production rates with Carboloy® cemented carbides performance-matched to your machining jobs

Aluminum, titanium, super alloys, wood—all have machining peculiarities that raise cain with production schedules and tool costs. That's why we make *five* job-tailored Carboloy cemented carbides for cutting these materials.

With these five grades (see chart, at left), you can get the one with exactly the right combination of shock resistance and wear resistance to match your job—whether heavy, interrupted cuts, or precision finishing.

Because you're using performance-matched carbides with consistent metallurgical quality, you can schedule heavier production loads . . . and you will get this increased output at lower tool-cost-per-piece.

Your local Authorized Carboloy Distributor has complete stocks of tools, blanks, and inserts in these five grades. A phone call to him today will get your machines humming faster tomorrow.

For more information on Carboloy Extra-Performance and General-Purpose carbides, or nonferrous material carbides, write: Metallurgical Products Department of General Electric Company, 11147 E. 8 Mile Street, Detroit 32, Michigan.

CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC

(Above) Red-hot steel slabs, weighing over 2 tons each, are at arm's length from hydraulic lines filled with Irus Fluid 902—YET NO FIRE HAZARD.

(Right) The distinctive yellow color of Irus Fluid makes it easy to spot and trace hydraulic line leaks.

"After numerous tests, we selected Shell Irus Fluid 902 because of its excellent fire resistance and low cost,"

says Norman Bracht, Lubrication Engineer, Alan Wood Steel Company, Conshohocken, Pa.

A fire in the strip mill, causing serious equipment damage and plant down time, convinced the Alan Wood Steel Company that a switchover to a fire-resistant hydraulic fluid was imperative. After extensive testing with various commercial types, Shell Irus Fluid 902 was selected. Now . . . twelve months later . . . Alan Wood is convinced that serious hydraulic fires in strip mill tilt table are a thing of the past.

Irus* Fluid 902 is a specially compounded water-in-oil emulsion which has exceptional fire resistance. Plant tests show, time after time, that Irus Fluid 902 *actually snuffs out fire!*

Many plant operators, like Alan Wood Steel, have discovered that Irus Fluid is economical . . . costing up to one-third less than other fire-resistant fluids, yet its performance is comparable in every practical respect.

If your present hydraulic equipment is vulnerable to accidental fire hazard, we suggest that you obtain complete technical information on Shell Irus Fluid 902. Write: Shell Oil Company, 50 West 50th Street, New York 20, N.Y. or 100 Bush Street, San Francisco 6, California.

*Registered Trademark

SHELL IRUS FLUID 902

a low-cost, fire-resistant hydraulic fluid

SHELL

For more information fill in page number on Inquiry Card, on page 161

PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS— to help you

HOW DeLAVAL SAVES 383 MINUTES ON PROBLEM PART

Automatic and turret lathes team up with JETracer equipment for large workpieces

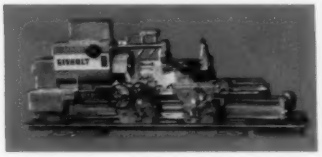
If you can apply this basic idea to your work, you're due for big savings. At the DeLaval Company's Poughkeepsie, New York, plant it cut former machining time 70% and eliminated a 1½-hour polishing job.

The workpieces are separator bowl shells of tough 302 stainless. The parts are rough-machined on two Gisholt No. 24 Automatic Production Lathes with JETracer-equipment. They are finished on two 3L Saddle Type Turret Lathes—each equipped with two JETracer slide tools mounted on the hexagon turret. Each JETracer slide tool is an independent unit with its own overhead sliding template carrier that locates for length from an adjustable bracket on the overhead pilot bar. Forward feed of the turret saddle causes the tracer stylus to follow the template contour, reproducing the form in the workpiece. The entire assembly indexes with the turret and does not restrict the use of other tooling.

A variable-speed, constant-h.p. (30) drive motor is used. An indexing speed template, at the rear of the turret carriage, indexes with the turret and provides a constant cutting speed when either JETracer slide is used, without stopping the spindle or removing the tool from the cut.

Finish Operation 1 on 3L

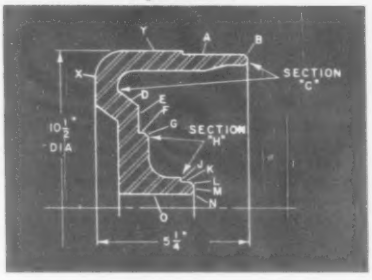
A 21″ chuck holds at Y, locates at X. Hex 1 tools rough F, rough-bore O. Hex 2 traces sections M-H-D. Tool post tools face B-J, turn K. Hex 3 finish-turns F. Hex 4 chamfers N and A is turned from the tool post. Hex 5 traces section C. Tool post tools chamfer B-G-L and F is finish-turned from hex 6. F.t.f. time, only 70 minutes.



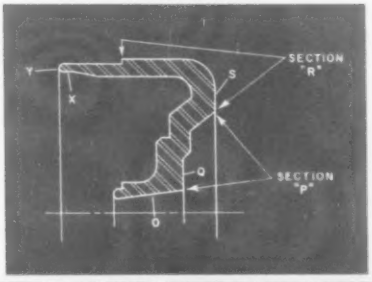
Operation 1

Finish Operation 2 on 3L

The workpiece is hand-clamped at S, centralized at X and located at Y for the second operation. Hex 2 step-bores O, and tool post tools rough-face Q in two passes and finish-taper-bore O in three passes, using the taper attachment on the square turret carriage. Hex 3 is open. Section P is traced from hex 4. The spindle is then stopped; an air-operated clamp is inserted, holding at Q; hand clamps are removed from S, and section R is traced from hex 1 to complete the part. Time, f.t.f., 30 minutes.

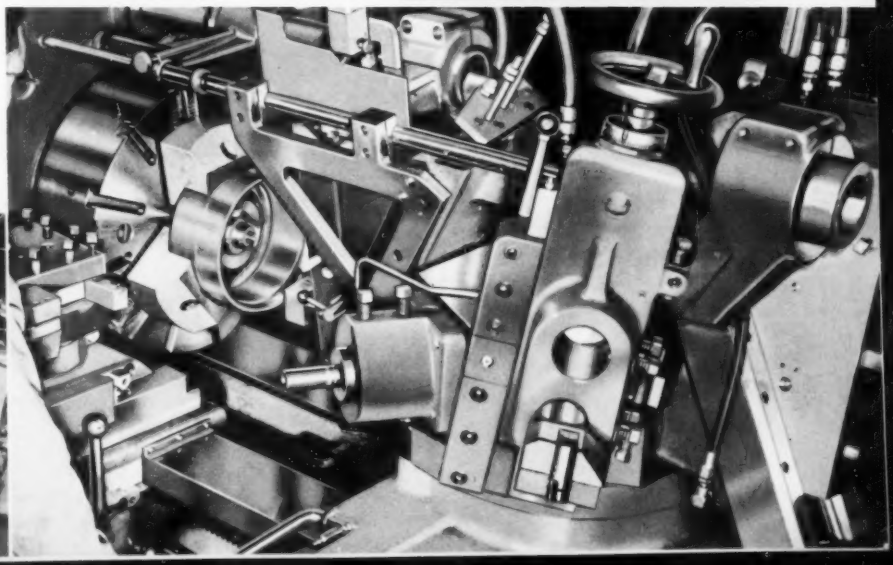


Operation 2

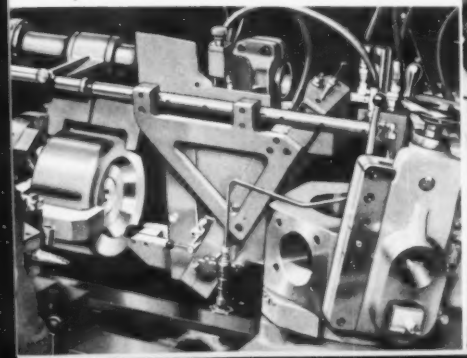


JETracer, using inexpensive single-point tools, machines complicated surfaces accurately, holding bores to .0008″, diameters to .0008″, depths to .004″. Combined No. 24-3L setup completes part in 167 minutes, saving 383 minutes over previous methods. 20 micro-inch RMS finish is obtained, saving a 1½-hour polishing operation.

Workpiece and tooling for first finishing operation on 10½″-diameter, 5¼″-wide bowl shell. Note JETracer slide tools mounted on opposing faces of the hexagon turret.



Close-up of workpiece and turret-mounted JETracer slide tool for second finishing operation. Note how overhead sliding template carrier locates for length from adjustable bracket on overhead pilot bar.



WANT TO SIMPLIFY FIXTURE WORK AND SAVE MONEY?

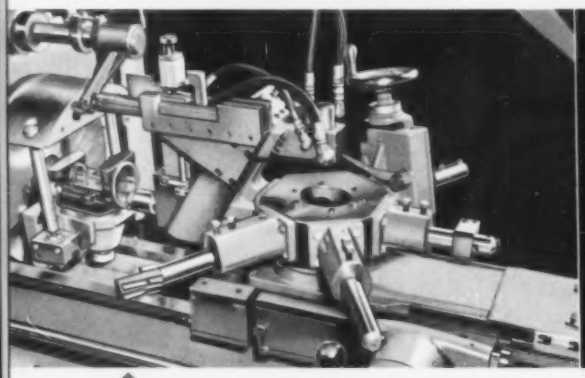
JETracer slide tool cuts tooling costs for ram type turret lathe work

If you have to machine parts held in fixtures or handle multiple-diameter boring operations, tuck this page in your files for reference. It shows how tracing can cut your costs, save time and simplify machining of parts like this chrome-nickel-steel truck steering knuckle forging.

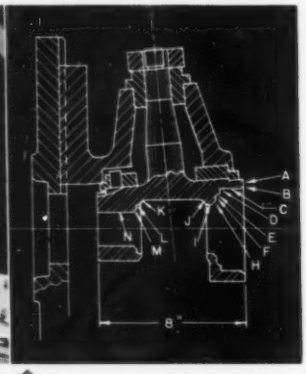
The spindle end, previously machined, is located from a circular slot on the spindle O.D. The part is hand-clamped in a counterbalanced angle plate fixture on a standard MASTER-LINE No. 5 Ram Type Turret Lathe. Although the part and fixture require a swing clearance of 21¾", the standard No. 5 handles it without modifications. A saddle extension is used to minimize tool overhang and provide maximum rigidity when finishing to close-tolerance bores.

The turret-mounted JETracer slide tool on hex 1 simplifies machining and eliminates the additional tooling normally required to machine the eight separate surfaces at the front of the part. Length setting is speeded by a feed dial, an integral part of the standard longitudinal feed handwheel assembly. As the turret ram feeds forward, the tracer stylus and the tool-carrying slide follow the template contour, generating surfaces A-B-C-D-E-F-H-I in one pass. A multi-diameter cutter on hex 2 machines L-M-N. N is finish-bored from hex 3 and diameters C-I are finished from hex 4. A rapid slide tool on hex 5 bores and forms J-K to complete the part. Tolerances on the 8"-long part are held within .0014" on bore C, within .001" on bore N and within .005" on bore I. F.t.f. time is only five minutes.

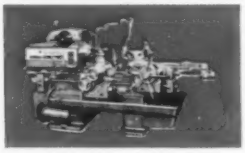
Turret-mounted JETracer slide tool saves time, eliminates need for usual cross-slide carriage and extra turret tooling, reducing original equipment cost. Entire JETracer assembly indexes with the turret and does not restrict use of other tooling.



Workpiece and tooling showing how tracer template and carrier bar obtain length location from adjustable bracket attached to overhead pilot bar. Note absence of standard cross-slide carriage and consider savings in original equipment and tooling made possible by JETracer.



Workpiece showing surfaces machined with this setup. Turret-mounted JETracer slide tool handles eight surfaces on right end of part in one pass, saving time and simplifying operator's job.



HOW SACO-LOWELL SHOPS INSPECT HIGH-SPEED TEXTILE PARTS

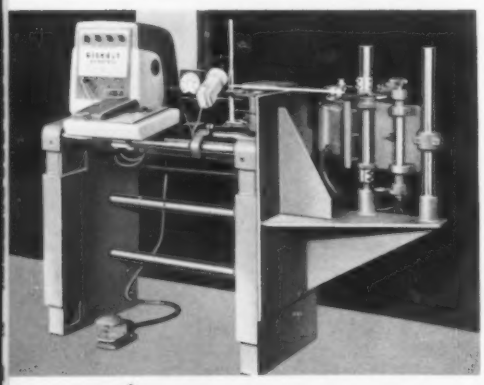
Balancing before assembly saves time, cuts losses

Vibration can be costly in the textile industry where speeds of 11,000 r.p.m. are not uncommon. At these high speeds, even small amounts of unbalance exert great force on supporting bearings and cause high-frequency vibrations that can lead to excessive maintenance and spoiled work. Here at the Saco-Lowell Shops, Biddeford, Maine, a Gisholt 1SM Balancer is used to check product quality *before assembly* to eliminate costly time and production losses caused by vibration in high-speed spinning operations.

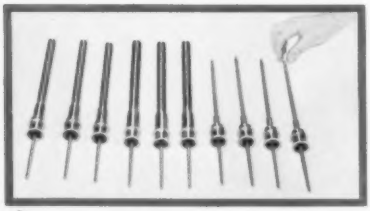
Typical parts shown below include whorl-and-tube and blade-and-whorl assemblies used to support and drive the tubes or bobbins of yarn used in manufacturing textiles. The long, lightweight spindle operates at from 8,500 to 11,000 r.p.m.

To simulate actual operating conditions, the balancer is set up to rotate parts in vertical position. Standard, horizontally mounted driving motor and vibration pickups are tipped 90° and mounted at the right end of the machine. A bolster insert, which is an actual part of the spindle, provides bearing surfaces to support the spindle blades and is held at the base end in a special vibratory fixture. The spindles are belt-driven from the crown pulley on the whorl as in actual production. The driving motor is easily adjusted, up or down, to align the pulley with the part when changing over to different sizes. Because electrical means are used to locate and measure unbalance, there is no restriction on the method used to support or drive the parts. Full machine accuracy permits measuring bearing movements as small as .000025" in either one or two preselected correction planes. The average workpiece is inspected for unbalance in less than one minute.

This simple, effective means of checking parts and assemblies before they are placed in operation eliminates costly time and production losses through broken yarn or rapid wear caused by excessive vibration of high-speed parts.



Driving motor and vibration pickups are mounted at right end of balancer to permit balancing of high-speed textile machinery parts in vertical position.



Typical parts checked for unbalance with this setup. Hand gives size comparison. Operating speeds of 8500 to 11,000 r.p.m. make inspection by balancer imperative for smooth, trouble-free operation.

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

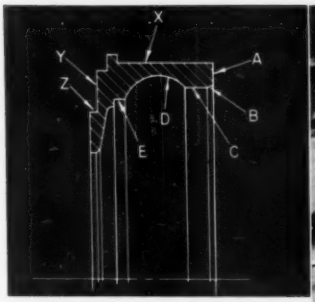
HOW TWIN DISC SIMPLIFIES CONTOUR MACHINING

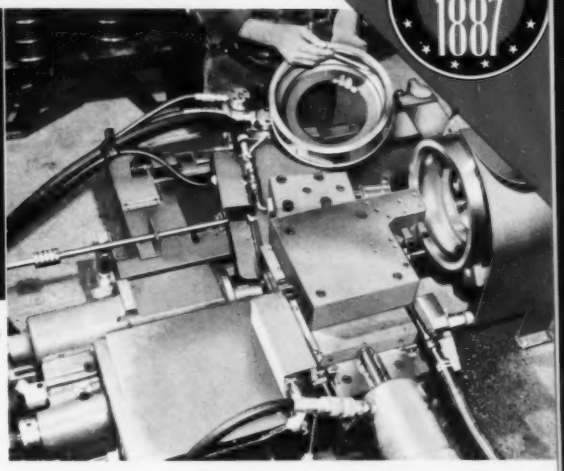
JETracer provides finer finish; auxiliary slide handles extra surfaces

Here's a way to avoid the high cost of form tools as well as the cost of regrinding and lost machine time while tools are changed and reset to size. It's the way the Twin Disc Clutch Company's Hydraulic Division plant at Racine, Wisconsin, uses a standard MASTERLINE No. 12 Automatic Production Lathe with modern JETracer to generate a large radius in cast iron rotating housings for hydraulic torque converters.

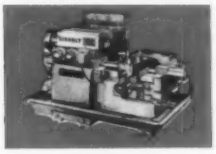
Special equipment includes a front-carriage JETracer slide and a single-pass template carrier, adjustable longitudinally and for taper. A variable-feed pump is used for the front carriage to provide a uniform feed rate to the single-point tracing tool, especially important for a fine surface finish as the tool generates the steep contour in the bore.

Here's the operation on a typical 12⅜"-diameter, 3⅜"-wide part. Surfaces X-Y-Z are previously machined. The work is centralized on diameter Z with a chuck-mounted pilot ring, located against face Y and chucked at X in a 15", 3-jaw, compensating-type air chuck. The front JETracer slide rough-bores C and generates the 31/32"-radius D. At the same time, the rear independent slide finish-bores C-E and chamfers B, using standard longitudinal feed movement. Then an auxiliary slide, mounted on the rear slide, rough- and finish-faces A to complete the part. F.t.f. time is only 3.12 minutes.





Operator indicates 31/32"-radius, 1⅜"-long-groove D. Note massive tool block, mounted on auxiliary slide to permit machining extra surfaces using standard longitudinal feed of rear independent slide and transverse feed movement of the auxiliary slide.



Three different part sizes are handled with the same basic setup. Change-over requires new sets of chuck jaws, a different pilot ring, rear tool block and tracer template, and adjustment of stops.

JETracer speeds and simplifies radius or contour machining, improves product quality. Variable feed provides fine finish in 31/32"-radius, 1⅜"-long-groove D. Rigid setup holds parallelism between faces and size of bore C within .003" tolerance.

SAME MACHINE SUPERFINISHES INNER AND OUTER TAPERS

Two-machine setup corrects part geometry, eliminates rejects, saves time

Here's how a big automobile manufacturer uses this high-production Superfinishing setup to correct part geometry and save time on difficult inner and outer tapered surfaces.

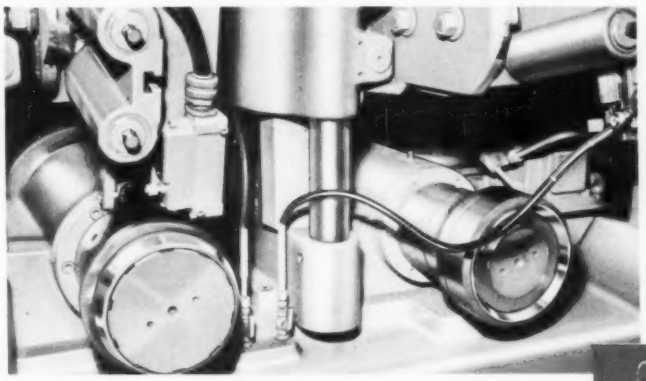
The workpieces are steel transmission cones which come to the Superfinisher turned, bored and heat-treated to 48-52 Rockwell "C", with a surface-finish of 80-100 micro-inches RMS. The operation is handled on two Model 54 High-Production, Two-Spindle Cylindrical Superfinishers. The Model 54 is ideal for this work since it is designed to handle parts of small or medium size, with two independent work stations.

Because previous operations cause some distortion and leave extra heavy walls on some pieces, one Model 54 is used to rough the O.D. and I.D. surfaces, correcting part geometry and cleaning up surface defects. The second machine produces the low micro-inch finish required for smooth operation and long service life.

The tapered outside diameter is handled on the left work station. The part is held in a fixture, centralizing and locating in the bore and clamping back on the lugs in the bore. The tapered inside diameter is handled on the right work station. The part is held in a collet-type fixture, centralizing and locating on the tapered O.D., clamping back against the lugs.

The roughing operation takes 40 seconds f.t.f. time at each station. The finishing operation is completed in only 30 seconds f.t.f. at each station. The final finish on both O.D. and I.D. surfaces is 3-4 micro-inches RMS.

Two-machine setup saves time, improves product quality. Using one Superfinisher to rough and another to finish virtually eliminates rejects because part geometry is corrected by roughing operation. Work flow is fast, from left to right, with one operator on each machine.



Close-up of tooling setup on two-spindle Model 54 Superfinisher. Tapered O.D. is handled on left station; tapered I.D. is handled by offset stone-holder on right station. General machine view shows control panels for individual stations that permit handling different operations on same machine.

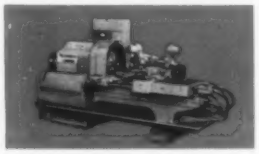
SETUP SAVES CUMMINS ENGINE COMPANY, INC., 1.5 MIN. PER PART

Combined operations cut time 35%, improve accuracy and finish

You'll want to remember this smart tooling setup at the Cummins Engine Company, Inc., Columbus, Indiana, plant. It shows how combined cuts are used to improve concentricity, parallelism and surface finish on die-cast aluminum diffuser plates for Cummins "Turbodiesel" Engines.

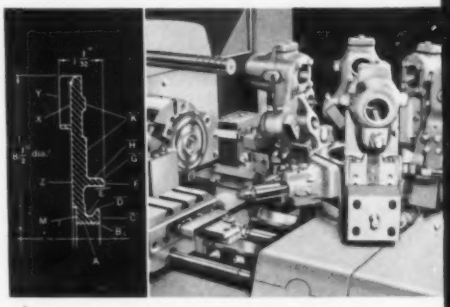
The machine is a MASTERLINE 1F Fastermatic Automatic Turret Lathe. Special accessories include a 2-speed motor, automatic forward and reverse spindle controls, a turret-facing attachment and a special turret-facing slide tool.

The parts are located against face X and held at W in a 12″, 3-jaw air chuck. Drive is against vane Y. Spring-loaded, manually locked pins provide extra support near center at Z.

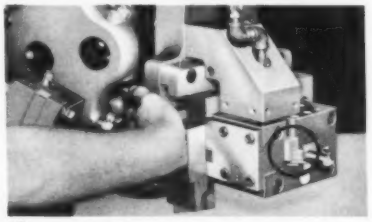


Here's the automatic machining cycle: Hex 1—drill A, rough-turn D-E-H, chamfer G while K is rough-faced from front cross slide; hex 2—semi-finish-turn H, bore A, chamfer B while rear cross-slide tools finish-face K, rough-face F; hex 3—turret saddle traverses forward and holds as turret-facing attachment on rear cross slide provides transverse movement to turret-facing slide tool, facing F-C and back-facing M at the same time. A cam-operated auxiliary slide, inside the turret-facing slide, follows an angular path, entering the limited space between face F and diameter D to undercut E. Reverse feed is used to clean up the surfaces and clear the tools for withdrawal. Hex 4—finish-turn H; spindle reverses and low-speed side of motor is used while a left-hand, 10 TPI thread is tapped in bore A from hex 5. When tap bottoms, turret dwells and spindle reverses to withdraw tap. Spindle speed is increased as A is bored from hex 6, removing the crest from the threads to create an oil-slinger groove. Groove depth is held to ±.006″ to govern flow of oil to the turbocharger. Time, f.t.f., is only 2.7 minutes.

Flexible automatic cycle and minimum special tooling permit machining of undercut, tapping and simultaneous facing of front and back surfaces; save extra operation and assure parellelism between faces.



Workpiece and tooling for die-cast aluminum diffuser plates. Rigid setup with overhead-piloted multiple tool holders simplifies holding close tolerances. Workpiece drawing at left shows surfaces machined.



Close-up of special turret-facing slide tool. Note cam-operated auxiliary slide, encircled, used to undercut E.

JETracer SAVES 71.5 MINUTES ON THIN-WALL PART

Four-pass JETracer slide saves time, improves accuracy and finish

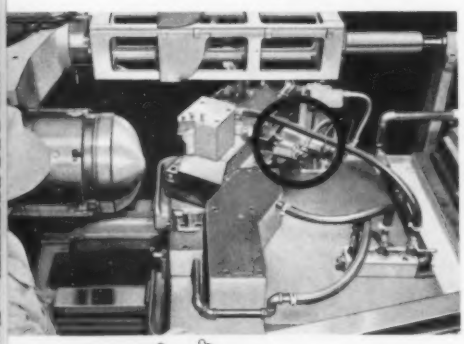
If you're having trouble machining thin-wall parts with difficult contour, facing or forming cuts, this setup at a well-known manufacturer's plant will give you fresh ideas.

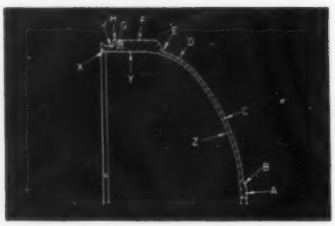
The workpieces are tough 4031 steel pressure bulkheads. A standard MASTERLINE Simplimatic Automatic Lathe is used. Special equipment includes a JETracer-controlled rear independent slide with a 4-pass indexing template carrier and variable-speed motor to provide a constant surface-cutting speed.

The 14″-diameter, 6⅜″-wide parts are located on face X, against a locating ring with jacks supporting at Z, and chucked at Y on a 15″, 3-jaw, air-operated chuck. Pie-shaped jaws centralize and minimize distortion.

Here's the automatic machining cycle: The platen table feeds to bottom and holds as dome face A is machined from the front slide. The table retracts and then feeds in while O.D. surfaces B-C-D-E are traced. A variable-spindle-speed control provides a uniform surface-cutting speed on all diameters. Then, the table and JETracer slide retract; the template carrier indexes, and the same surfaces are traced again. Four passes are required to finish O.D. contour. After the last JETracer pass, the front slide forms locking groove surfaces F-G-H-J. Final wall thickness is .073″. Surface finish is 40-50 micro-inches RMS. Time f.t.f., 18.5 minutes.

Multiple-pass JETracer slide permits one to three roughing cuts and final finish cut. Relatively inexpensive accessories and standard Simplimatic save extra operations and cut 71.5 minutes from previous time on this job.





Compact tooling arrangement simplifies machining of problem part. Note 4-pass indexing template carrier above independent JETracer slide. Rheostat, encircled, at right of JETracer slide varies spindle speed during tracing.

No. 7-858
710

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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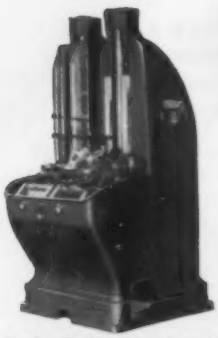
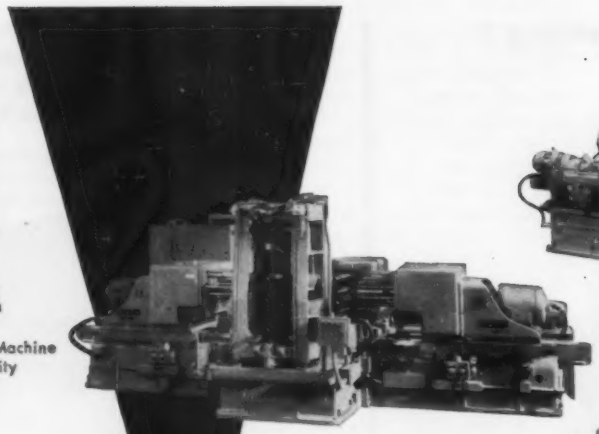


Duplex Surface Broaching Machine
5, 10, 15 and 25 Ton capacity



Three Way, 63 Spindle Central System Type, Hydraulic Feed, Horizontal Drilling and Boring Machine with Hydraulically Operated Fixture in Loading Position

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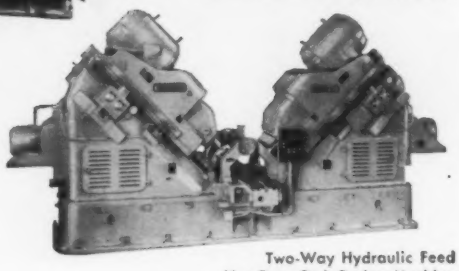

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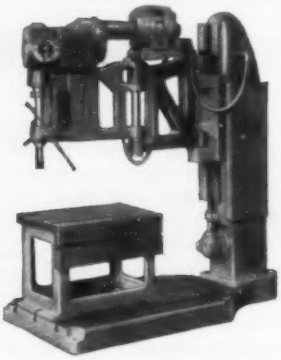

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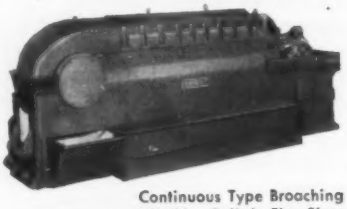

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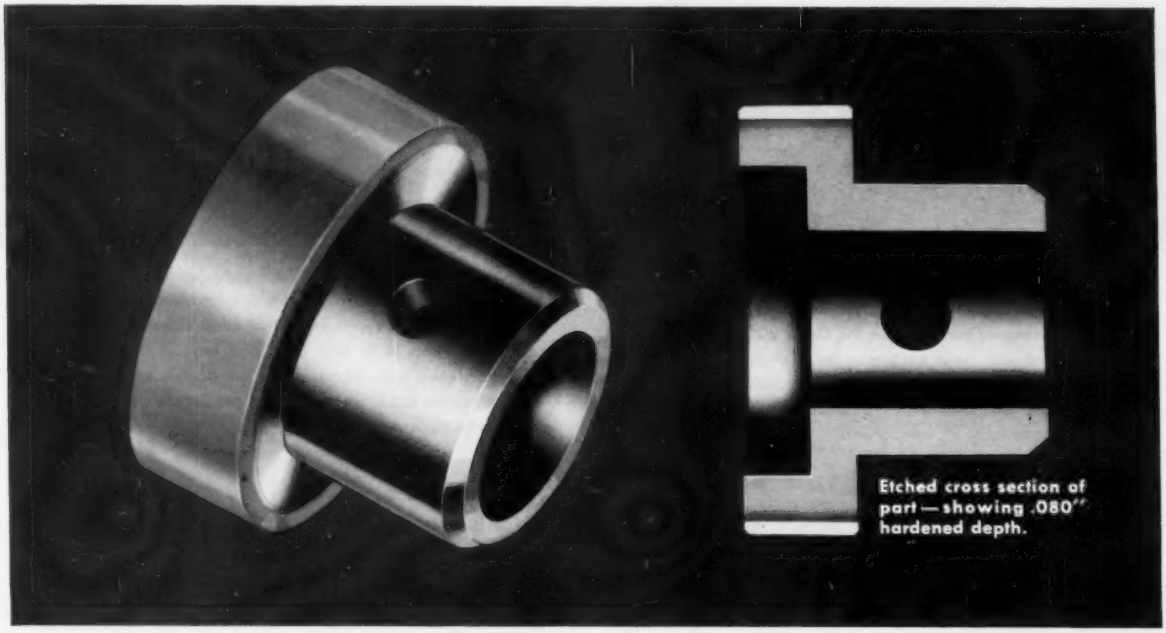

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DELTA INDUSTRIAL

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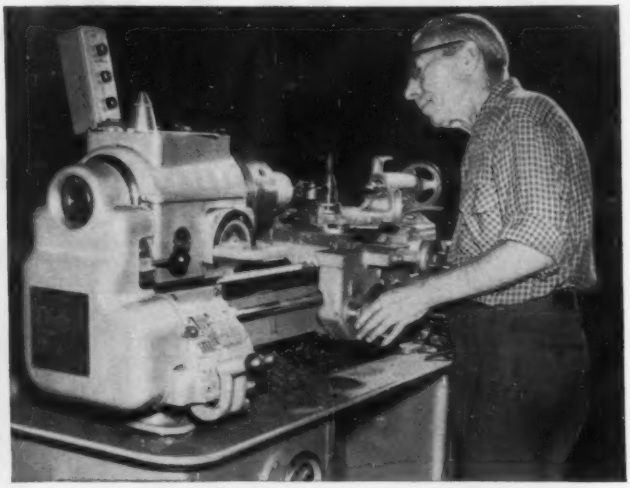

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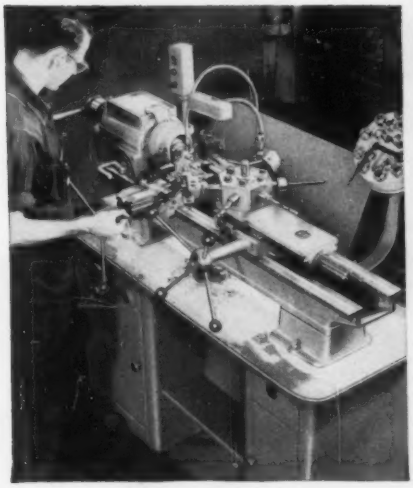

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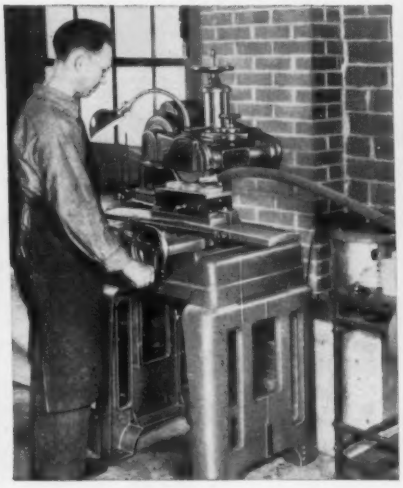

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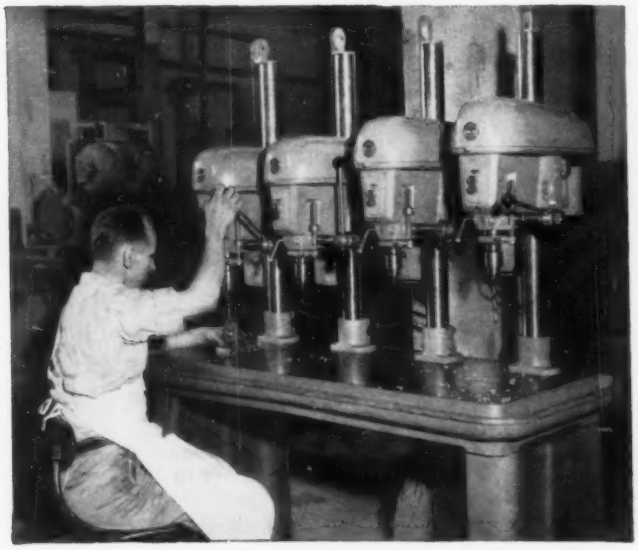

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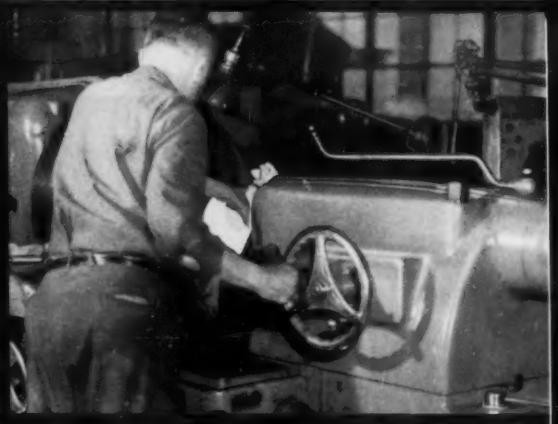

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Scott Wipers keep plant cleaner, eliminate skin complaints at Acme Steel

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SCOTT PAPER

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See "Father Knows Best" on NBC-TV.

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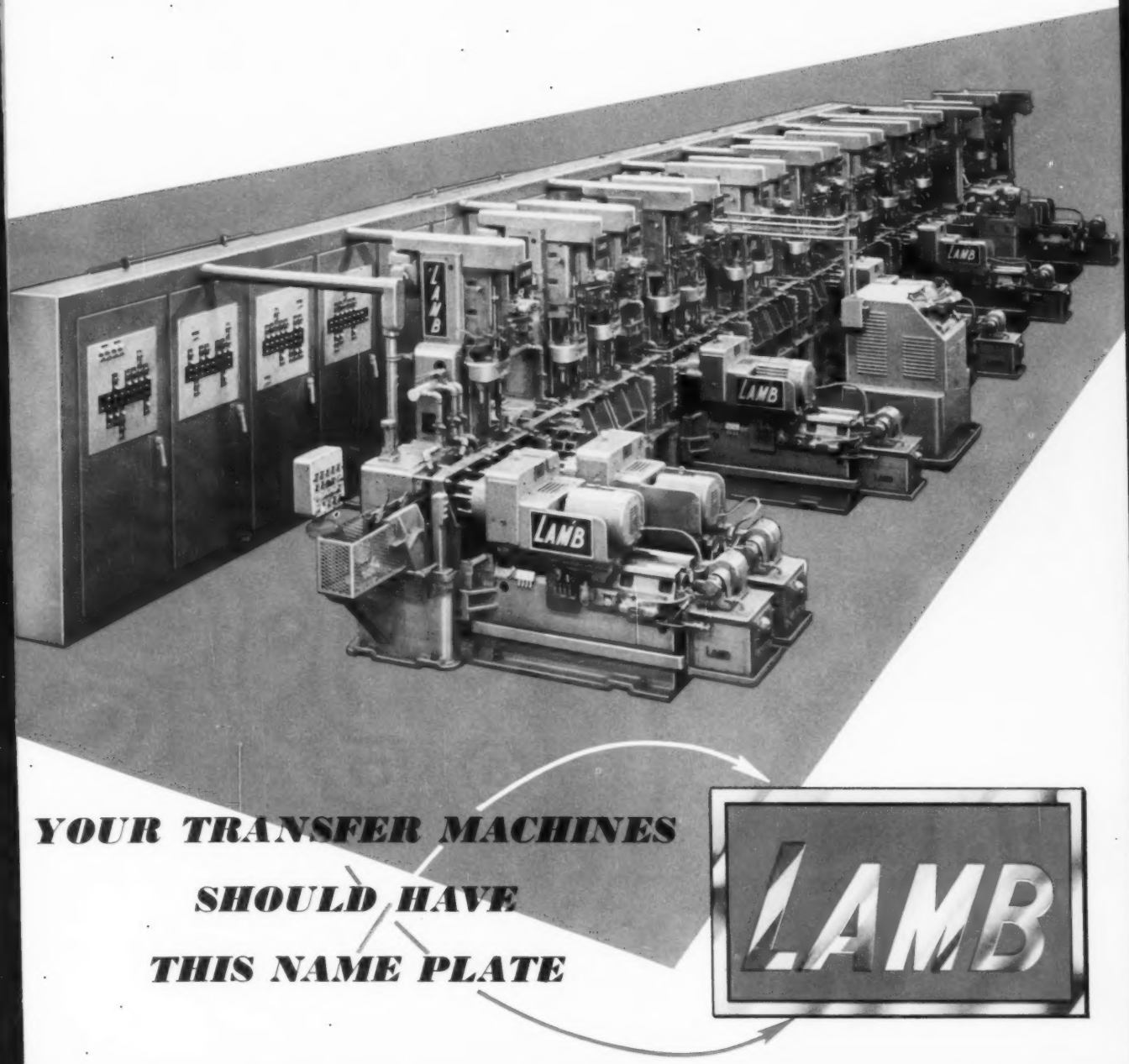

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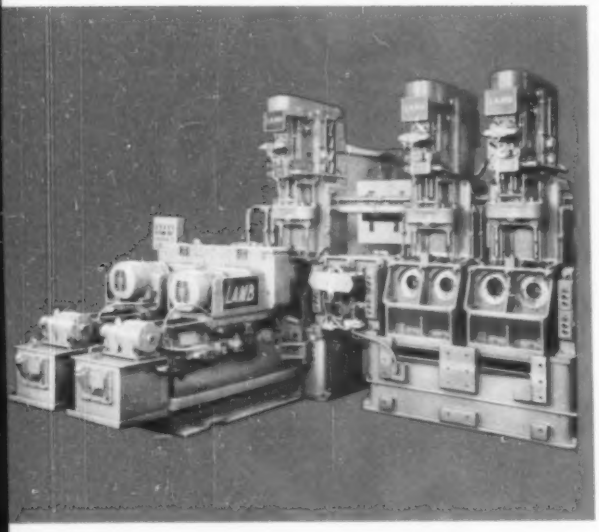
Another Superior Transfer Machine . .

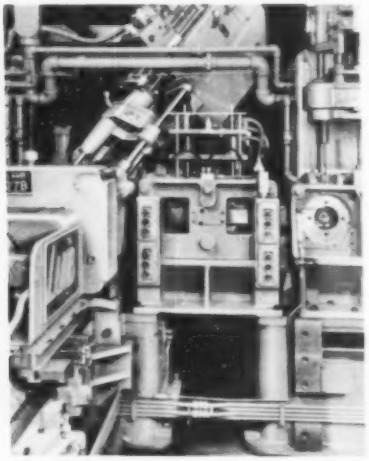
Building-Block Construction and Standard Components for Inexpensive Part Change



This Lamb transfer machine exemplifies the "Building-Block" principle of unitized construction. The main base is a series of blocks. These blocks support the fixtures and accessories and have machined square mounting faces for attaching wing and column base units. Lamb standard way-type units with hardened steel ways are used for heavy thrust milling, drilling and tapping operations. Standard quill-type, self contained hydraulic power units perform light thrust operations. Each working station has a fixture with integral clamping. Consequently, each station is a self-sufficient machine built of interchangeable components. Plate type work head construction for way units simplifies hole pattern change and reduces cost substantially.

These techniques in transfer machine construction afford exceptional ease of component rearrangement for production flexibility. Machine obsolescence due to product design changes is reduced to a minimum. The main base mounting pads are machined even though they are not used . . . a feature which means big savings later should additional wing units be required for added operations.

Greater Accessibility in Less Floor Space

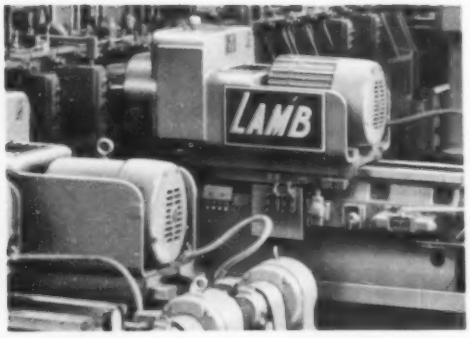


Maximum utilization of each working station permits an "open" arrangement of components without using excessive floor space. Greater accessibility means faster, more convenient service, maintenance and tool change. It promotes better housekeeping and improves working conditions. All are indirect benefits that contribute to overall manufacturing efficiency. Lamb's "open" design makes it simple to add inspection equipment or additional tooling as required.

Engineering Ingenuity

Features that solve present and future production problems are shown in the illustration at left. The angular quill unit (upper center) is arranged with a two-spindle driving head to drill a 35° angular oil hole in each of two parts. Normal approach would not permit sufficient clearance for bushing, therefore a traveling bushing is used in the clamp. Multiple probe above fixture uses only one limit switch to signal a hole obstruction—broken drill or no hole. Probes can be removed and replaced in seconds. See narrow page for more details on probes.

Note piping connections above and below fixture. Grouping of connections simplifies original machine installation and possible future rearrangements.



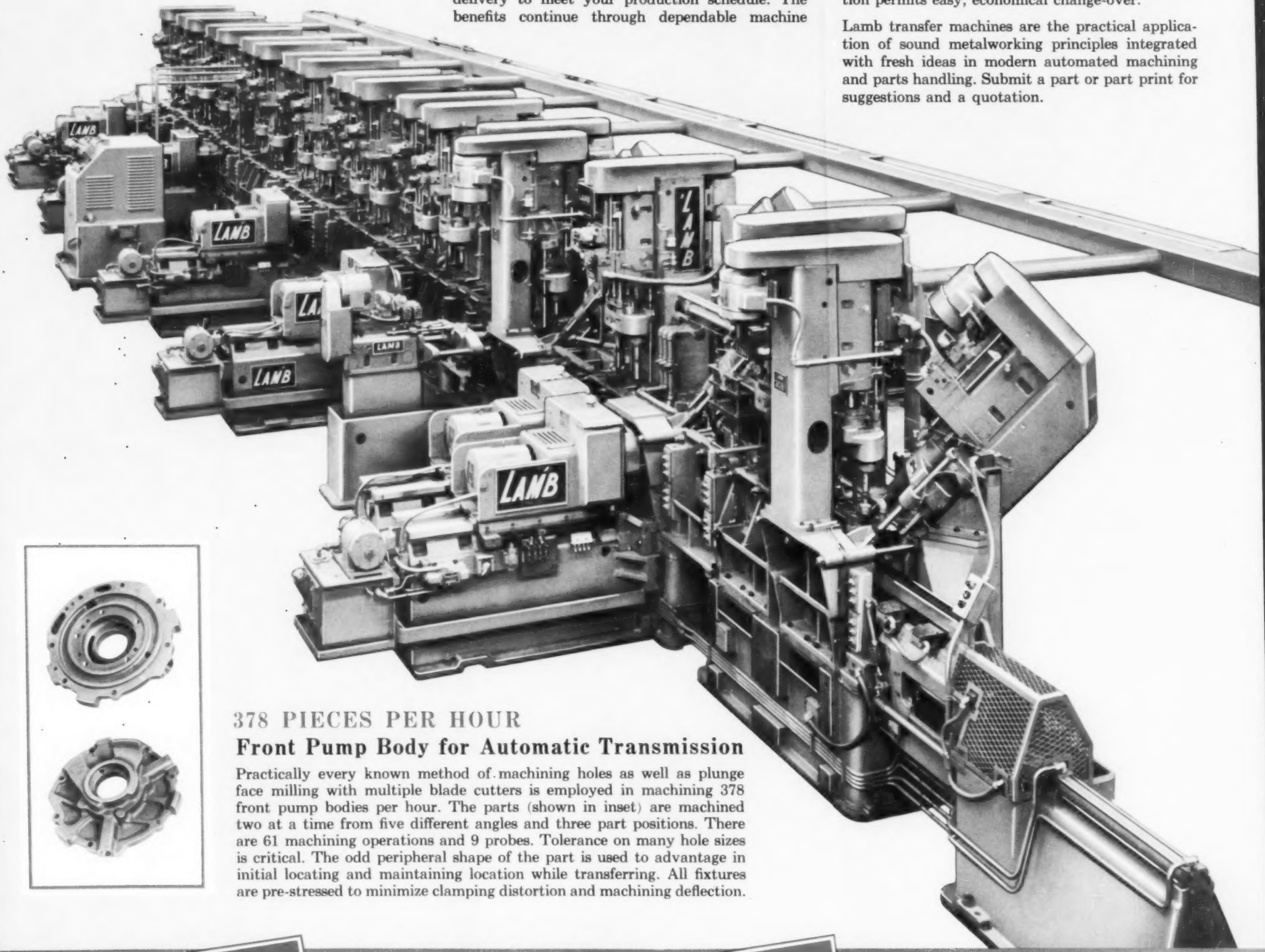
Plunge Facing

Plunge face milling of an intermittent surface is performed with a multiple blade cutter carried on a rigid spindle. Two massive guide bars on the work head enter into fixture guide bushings to provide maximum rigidity that results in improved accuracy and better work finish with faster feeds and speeds.

. because of LAMB'S Knowledge of Manufacturing Methods

The benefits you receive when you specify "LAMB" for your next transfer machine, begin with manufacturing-experienced engineering and on-time delivery to meet your production schedule. The benefits continue through dependable machine operation, high efficiency and manufacturing convenience. Then when part or product redesign occurs, Lamb "building-block," unitized construction permits easy, economical change-over.

Lamb transfer machines are the practical application of sound metalworking principles integrated with fresh ideas in modern automated machining and parts handling. Submit a part or part print for suggestions and a quotation.

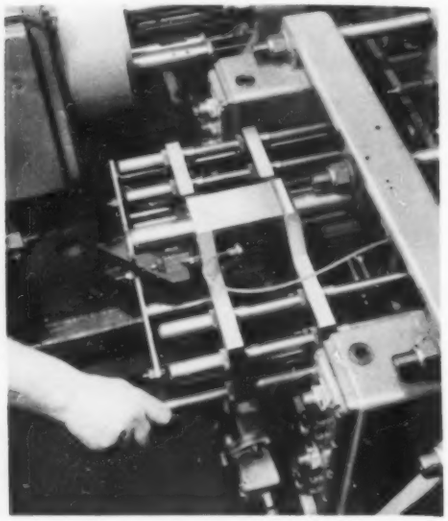


378 PIECES PER HOUR

Front Pump Body for Automatic Transmission

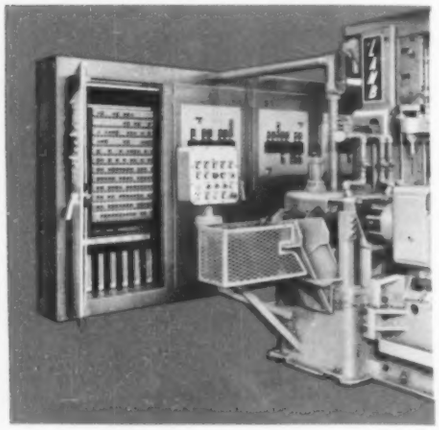
Practically every known method of machining holes as well as plunge face milling with multiple blade cutters is employed in machining 378 front pump bodies per hour. The parts (shown in inset) are machined two at a time from five different angles and three part positions. There are 61 machining operations and 9 probes. Tolerance on many hole sizes is critical. The odd peripheral shape of the part is used to advantage in initial locating and maintaining location while transferring. All fixtures are pre-stressed to minimize clamping distortion and machining deflection.

LAMB ENGINEERING IS PROGRESSIVE



A New Idea in Probes

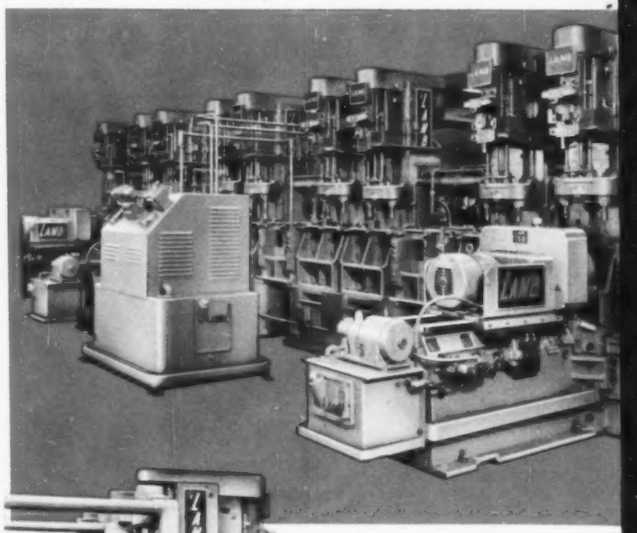
Multiple probes require only one limit switch for indication of hole obstruction. Two springs and retainer plate hold the probes securely against the spacer plate which is actuated by the cylinder. Any probe can be replaced in seconds simply by lifting the retainer plate and sliding the probe out of its bushing. Blow out jets assure accurate probing.



Static Control

Lamb keeps abreast of the latest developments in the machine tool industry. This illustration shows a portion of the new Static Control which features plug-in components with no moving parts. It reduces electrical down time and provides circuit design flexibility. Another Lamb feature is the schematic pilot light system which indicates station function or malfunction.

LAMB ENGINEERING Recognizes the Importance of SIMPLIFIED MAINTENANCE



Quick Tool Change

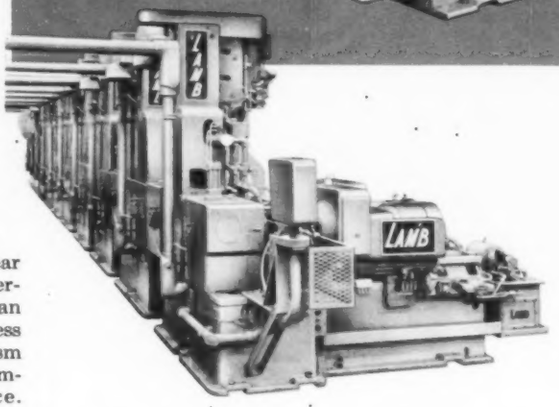
Vertical slides, way units and quill units can be completely retracted for fast tool change. Design of machine avoids hard-to-get-at work areas and incorporates preset tool holders throughout to keep tool change down time at a minimum.

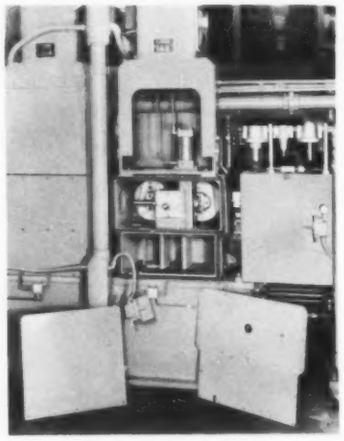
"Packaged" Hydraulic Power Units

Hydraulic power units conform to JIC standards. Individual hydraulic components are selected to suit users spare parts inventory and for service familiarity of maintenance personnel.

Hydraulic Manifolding

Manifold mounted valves are used to minimize piping and the possibility of leakage. Maintenance is simplified.





Easy Access

Cover plates over rear of fixtures protect operating elements and can be removed for access to clamping mechanism and other machine components for service. Vertical and one side horizontal machine configuration increases accessibility, saves floor space, improves overall appearance.

A Clean Machine

Clean lines and uncluttered appearance are the result of compact assemblies conveniently located, yet avoiding protrusions which might be damaged by aisle traffic. A recess within the machine base is provided to conceal piping and conduit whenever possible.

This modern facility is completely staffed and equipped to provide industry with the finest in automated materials handling equipment and in special and transfer type machines.

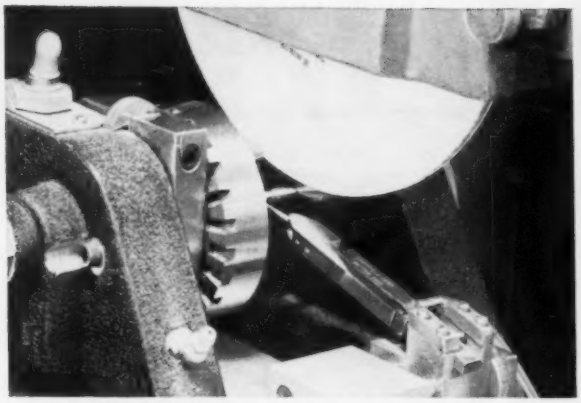
LITHO IN U.S.A.

F. JOS. LAMB CO. SINCE 1914

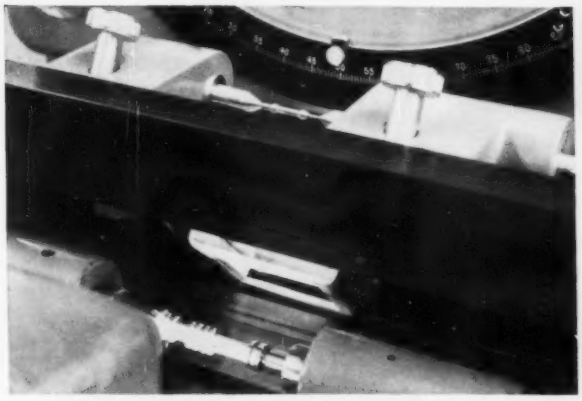
8099

5663 E. NINE MILE ROAD • DETROIT 34, MICHIGAN

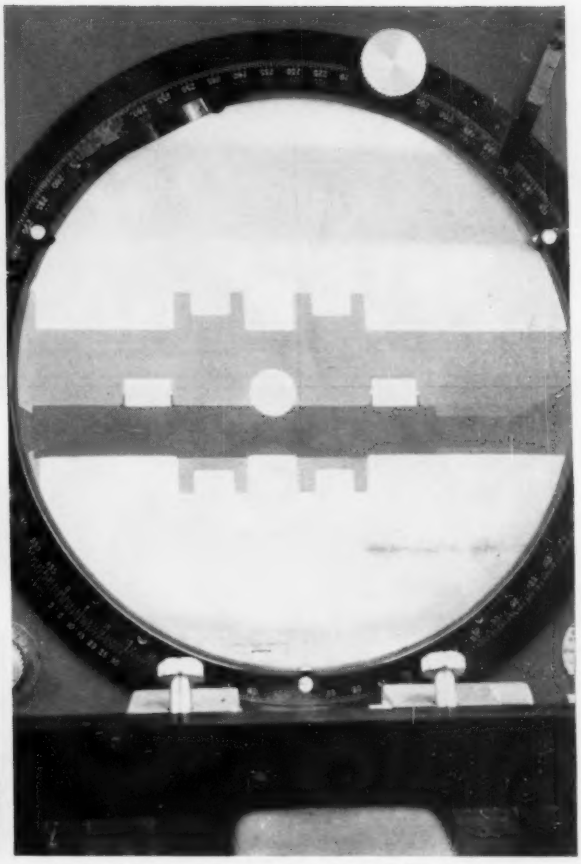
Engineers and Builders of Special Machines and Automation Equipment



1. Piston lands on hydraulic control valves are trimmed on a surface grinder fitted with motorized centers.



2. After trimming, piston and sleeve are mounted on worktable of Kodak Contour Projector for simultaneous projection by two light sources to gage amount of stock removal.



3. Overlap of piston and sleeve images is indicated by black area; overlap can be measured quickly by traverse of one part and observation of dial indicator.

How to do a 7½-hour gaging job in half an hour

How would you solve a gaging problem like this one?

In developing hydraulic control valves, engineers at a major firm producing aircraft components worked out a neat method of trimming piston lands in relation to ports in their mating sleeves.

But meeting the required .0002" overlap between piston lands and sleeve ports meant using several different gages to determine the amount of stock which had to be trimmed. Result: *7½ hours to trim each valve.*

To solve the problem, quality control engineers now use a Kodak Contour Projector with two light sources and two filters, one red and one green. This system projects a superimposed image of the piston on the sleeve. Where an overlap occurs, the red and green images combine into a black image. The width of this black overlap gives the amount of trim required. Result: *just ½ hour needed—7 hours saved on each valve!*

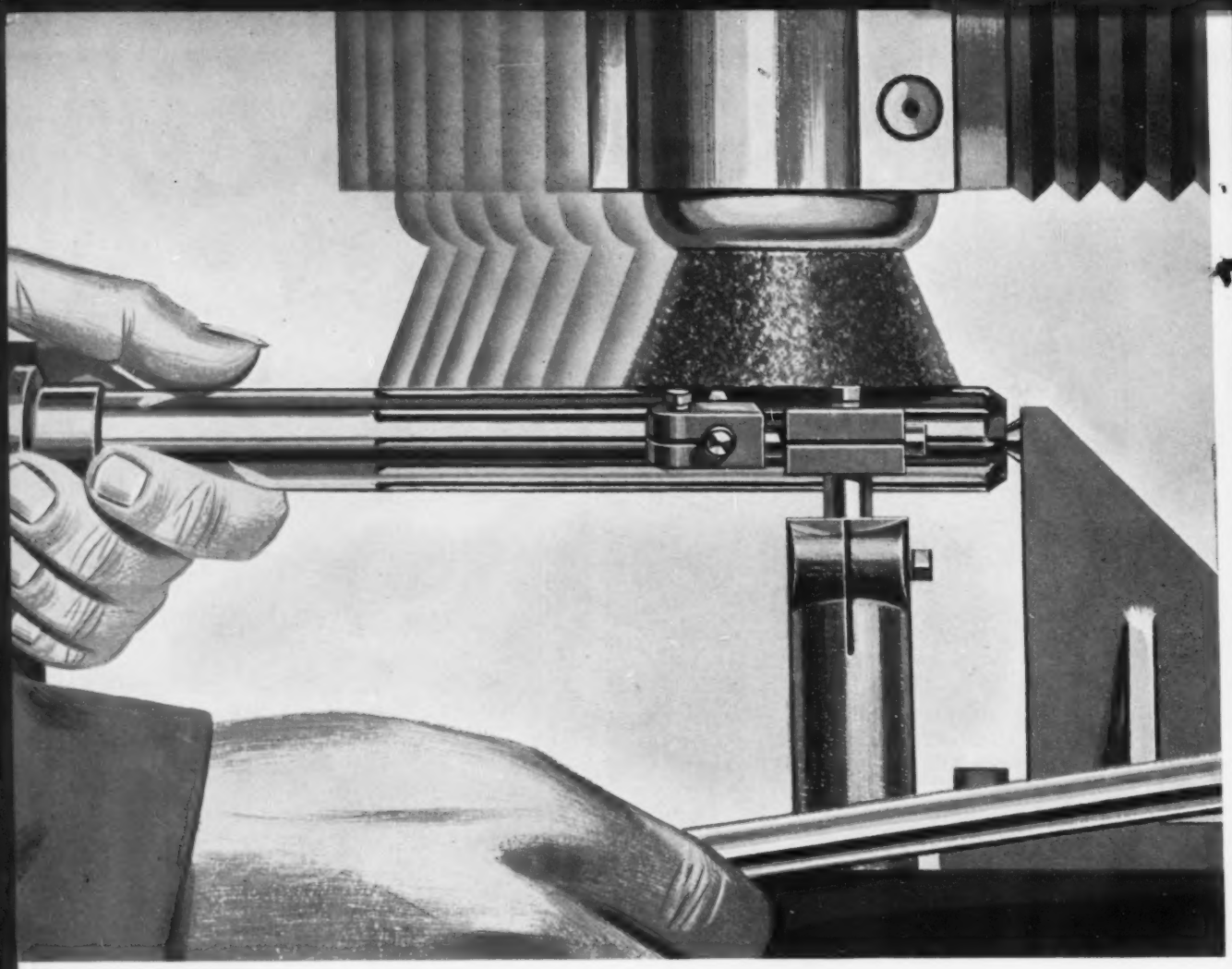
Maybe you've come up against a gaging problem that's eating up time and money in large quantities. To learn how you can solve it by optical gaging, send for the booklet "Kodak Contour Projectors." Write to:

Apparatus and Optical Division
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

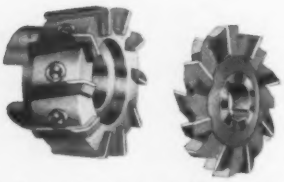
Kodak
TRADE MARK

For more information fill in page number on Inquiry Card, on page 161



Oliver "ACE" Tool and Cutter Grinder

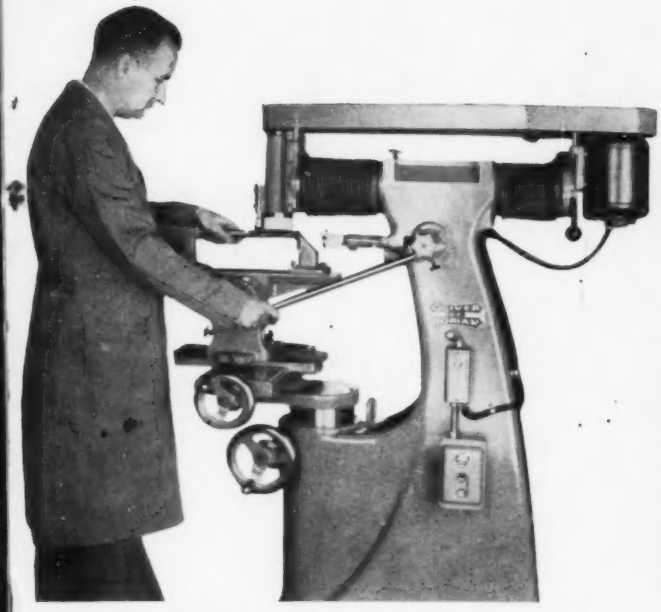
WHEEL TRAVERSES . . . *not the work!*



Face mills, reamers, hobs, spot facers—all cutters straight or spiral —are quickly, easily and economically sharpened with the Oliver "Ace."

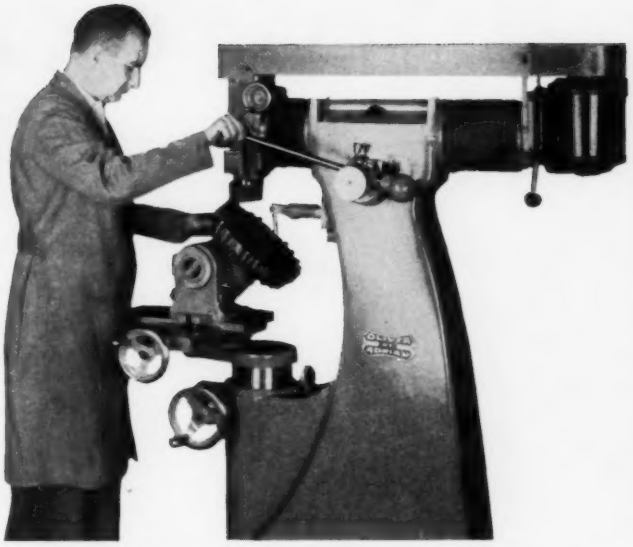
You can grind tools and cutters more accurately with the Oliver "ACE" because the wheel is brought *to the work*, reversing the usual process. Abrasive dirt and grit cannot cause wear because the cross carriage is not in motion. The horizontal ram which supports the grinding head moves in special bearings and is fully enclosed, sealed against dust and dirt. Further accuracy is assured because the wheel can be trued by a stationary diamond which provides a fixed grinding line. It is not necessary to reset the cutter to compensate for wheel wear.

The "ACE" is a universal tool grinder designed expressly for tool grinding—not a general purpose machine *adapted* to tool room work. It is simple to set up. All clearance angles are obtained by direct reading. Operators stand in a natural position with the control lever in easy reach and the work in direct view.



OLIVER Standard "ACE"

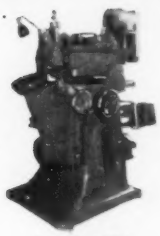
This machine is for high speed and light duty carbide grinding. Only two fixtures are required to handle a complete range of tool and cutter sharpening. Clearance angles are obtained by tilting the grinding wheel the desired amount as indicated on a scale graduated in degrees.



OLIVER Heavy-Duty "ACE"

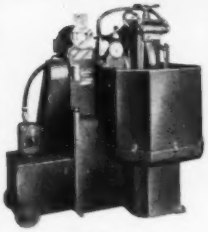
. . . for grinding tungsten carbide cutters and tools in all of their many forms. Because it is for use with hard metals, all components have been designed with rugged going in mind. Like the standard "ACE," grinding is done on the top tooth, not on the side of the cutter. The operator has full vision at all times.

More OLIVER of ADRIAN Tool Grinding Equipment



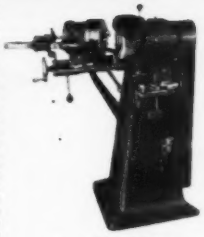
FACE MILL GRINDER

Completely automatic. A machine tool designed for accurate grinding. Wheel dressed with every stroke.



TEMPLATE TOOL BIT GRINDER

Controlled form grinding for high speed, stellite and tungsten carbide single point tools.



No. 510 DRILL POINTER

Semi-automatic. For drills ¼" to 3" in diameter. No. 21 bench models available for size ½" and smaller.

DRILL POINT THINNER

For low cost reclaiming of drills. Corrects off-center and too-thick webs and out-of-index cutting edges.

DIE MAKING MACHINE

Produces dies, gages, cams, templates, stripper plates, etc. at greatly reduced costs. 5 designs in 2 types.

Just check the coupon for literature on the OLIVER of ADRIAN machine you are interested in. Send it today to . . .

OLIVER of ADRIAN

OLIVER INSTRUMENT COMPANY

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- ☐ Drill Pointer
- ☐ Face Mill Grinder
- ☐ "Ace" Universal Tool and Cutter Grinder
- ☐ Literature only
- ☐ Die Making Machine
- ☐ Drill Point Thinner
- ☐ Template Tool Bit Grinder
- ☐ Quotation requested

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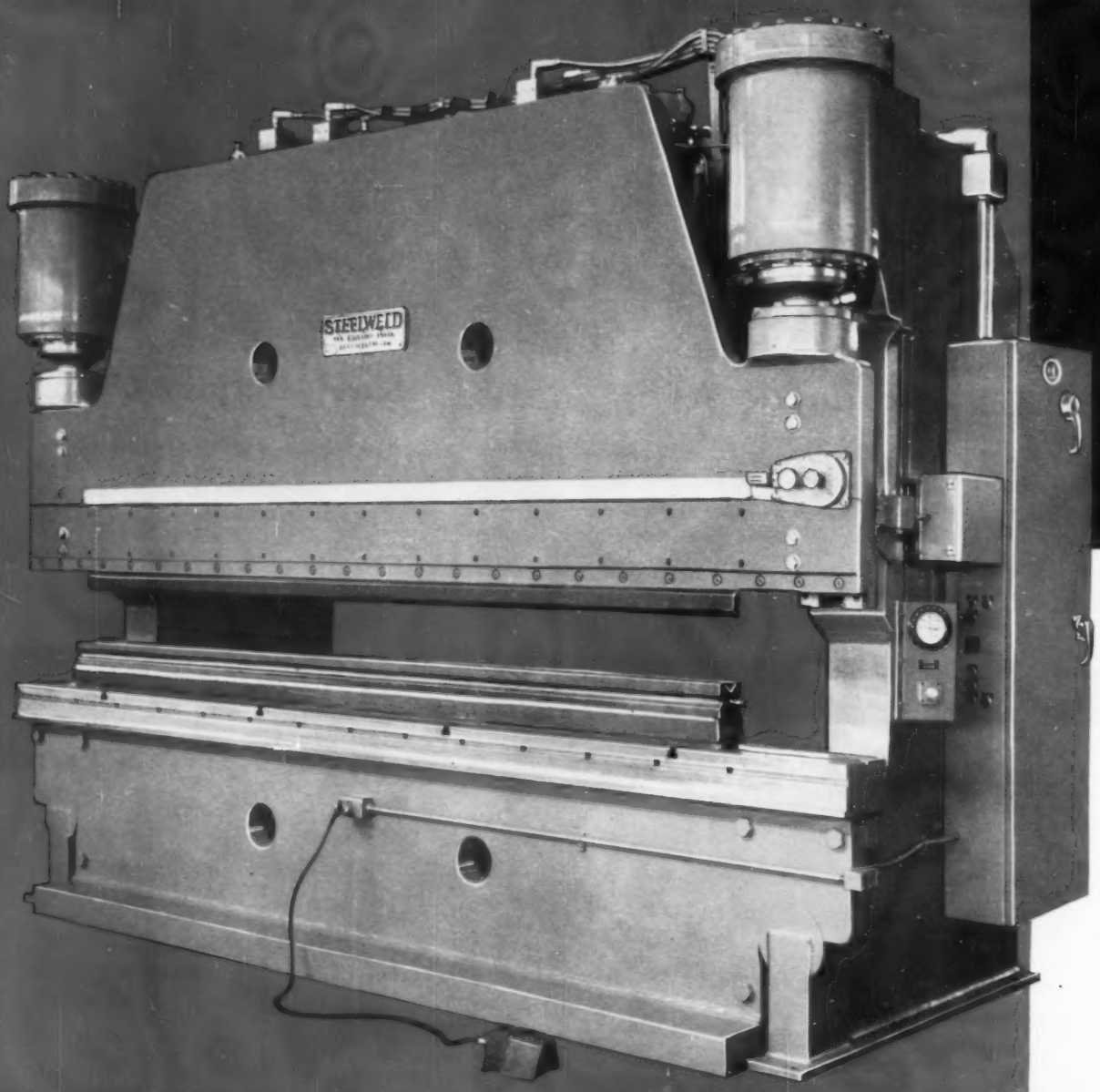
Introducing a



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NEW LINE of

STEELWELD HYDRAULIC PRESS BRAKES

Capacities to 2000 Tons

- **Positive overload protection.**
- **Constant power during entire stroke.**
- **Ram reversible at any point.**
- **Stroke quickly adjusted for any length.**
- **Fast ram approach and return—slow-speed pressing.**
- **Operating pressure simply adjusted.**
- **Accurate ram level automatically maintained.**
- **Ram easily tapered.**
- **Simple, safe to operate.**

CLEVELAND CRANE is proud to present its completely new series of Steelweld Hydraulic Press Brakes for bending mild steel from 10 gauge to 2 inches and in lengths to 30 feet.

Heavily built and of finest quality throughout, the machines are of the most advanced design with all features found desirable for ease of operation, maximum production and outstanding performance.

Steelweld hydraulically operated brakes are versatile machines capable of handling a wide variety of operations. They are ideal for jobbing shops, as well as for mass-production work. They work to close tolerances and have ample speed.

The new line of hydraulic brakes supplements the Steelweld line of mechanical press brakes, which Cleveland Crane has been building for more than 25 years, but does not supplant it. Each type of machine has its advantages and careful consideration must be given to the specific application to determine the type and size machine most suitable.

We urge you to get the facts on these new machines that have so much to offer you. Our sales engineers will be glad to give you the details. Or write for our new catalog below.

STEELWELD PRESSES

THE CLEVELAND CRANE & ENGINEERING CO.

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it was a fully automatic forging operation... until we started to forge

Even the best automatic forging machines can be slowed down by one simple thing. The steel you forge.

Unless the steel is really uniform, you'll be interrupting production to change the setup. These readjustments take time, limit the availability of expensive equipment—until it's hardly automatic any more.

With Timken® steel you get uniformity down to the last ounce. We take extra steps to make our steel uniform from bar to bar, heat to heat, order to order. For instance, we use the industry's first magnetic stirrer. It distributes alloys evenly, works the slag constantly at a uniform temperature. And we eliminate guesswork by using the industry's first direct-reading spectrometer to insure more uniform grain size and chemical composition.

What's more, we treat each order individually. Right from the start, an order is processed with the customer's end use in mind.

Why not insure wide-open, fully-automatic operation with your machines? Specify Timken fine alloy steel. You'll get uniform results every time without paying a penny extra. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U. S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

Here is

INFISPEED...

a **new** profit maker built into

CINCINNATI

Sliding Head Drills!

HEAVY DUTY Models in 21" and 25" sizes; floor type; box column in single and multiple spindle, round column in single spindle only. 60 to 1825 rpm with 3 hp motor, 1½" drilling capacity.

MEDIUM DUTY Models in 16" and 24" sizes; bench and floor types, single and multiple spindle. 450 to 3000 rpm, with 1 hp motor, 1" drilling capacity.

New INFISPEED gives you the exact speed you need for each drilling job; infinitely variable spindle speeds within the speed range. Fast operating too! Speed change control is right on the front of the machine, with all other controls. Adjacent tachometer shows exact rpm's.

Cincinnati INFISPEED Sliding Head Drills are built in four sizes, with all of the well-known Cincinnati profit-making features included, of course. Ask your CL&T dealer for details, or write us direct.

Improved Machining Through Research

CINCINNATI LATHE AND TOOL CO.

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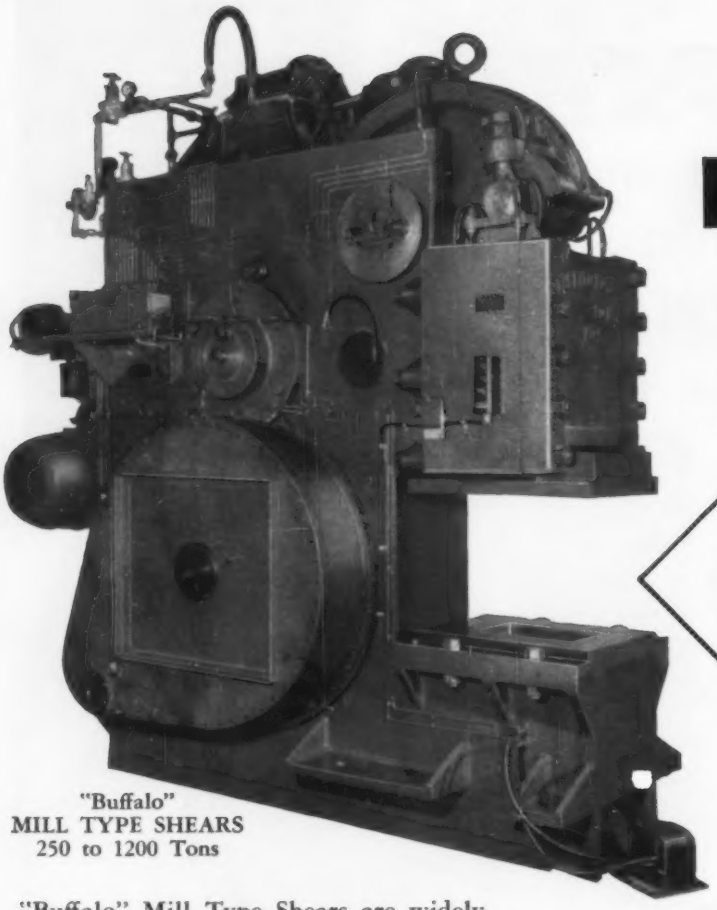
"Tray-Top" Lathes/"Cincinnati" Drilling Machines/"Spiropoint" Drill Sharpeners



"Buffalo"
MILL TYPE SHEARS
250 to 1200 Tons

PLENTY OF POWER

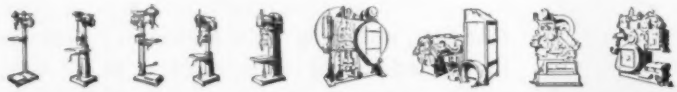
PLUS PLENTY OF TOOLING SPACE

FOR HEAVY DUTY PUNCHING, SHEARING, BLANKING

"Buffalo" Mill Type Shears are widely used throughout industry for performing heavy work falling between that produced by the standard C-type punch or shear and the four-column or straight side press.

Ideal for heavy-duty punching, shearing or blanking, these husky machines offer many unique features not found in standard shearing equipment. For example, the tooling space is not only very generous horizontally — its ample height permits the use of relatively heavy top and bottom bolsters on the plunger face and table.

"Buffalo" Mill Type Shears are available in 12 sizes — from 250 to 1200 tons, depending on the stroke length. For full information, contact your nearby "Buffalo" machine tool dealer, or write for Bulletin 3650.



BUFFALO FORGE COMPANY

440 Broadway • Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

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how TEXTILE MACHINE WORKS reduces to careful analysis their cost savings opportunities

TEXTILE MACHINE WORKS
READING, PENNA.

NO. 36
DATE: 9/15/56

2 Shift Operation

CAPITAL EQUIPMENT REPLACEMENT ANALYSIS

1 SUBJECT OF ANALYSIS: Automatic Machine - VS -
2 Present Machine
3 ANTICIPATED RATE OF PRODUCTION: based on 48700 pcs. produced on present machine at an average of 13.8 pcs. per hour - new machine averages 25.5 pcs. per hour.

PROPOSED EQUIPMENT	PRESENT EQUIPMENT
4 DESCRIPTION: Automatic Machine	PURCH. DATE: 1945(Used) MACH. NO. 2-157 DESCRIPTION: Machine
6 EST. PRIMARY SERVICE LIFE: 10 YEARS	YEARS OF LIFE TO DATE: INSTALLED COST: $5,055.34
7 EST. TERMINAL SALVAGE VALUE = (X) = $ 1,000.00	
8 EST. COST INSTALLED = (Y) = $ 14,948.00	LOCATION: Bldg. #6 DEPT NO: 2
9 TERMINAL SALVAGE FACTOR = X/Y = 6.7 %	INTENDED DISPOSAL: Sale RESALE, SALVAGE OR CONVERSION VALUE: $ 1,000.00

FACTOR	PROPOSED EQUIPMENT	PRESENT EQUIPMENT
10 DIRECT LABOR (FOR ANTICIPATED PRODUCTION):	$ 4,200.00	$ 7,780.00
11 INDIRECT LABOR (FOR ANTICIPATED PRODUCTION):	144.00	265.00
12 TOOLING:	400.00	
13 DEFECTIVE MATERIAL LABOR WORKS EXPENSE:		
14 DOWN TIME:		
15 NORMAL MAINTENANCE:		100.00
16 SPECIAL REPAIRS:		
17 POWER CONSUMPTION:	107.00	222.00
18 SUPPLIES:		
19 FLOOR SPACE: (IF USABLE)		
20 PROPERTY TAXES & INSURANCE:		
21 SUB CONTRACT COSTS:		
22 ~~OVERHEAD~~ - Profits from additional		
23 time available 2 shift operation		1,720.00
24 TOTALS:	B $ 4,851.00	A $ 10,087.00
25		B $ 4,851.00
26 NEXT YRS. VARIANCE IN OPERATING COST: (A MINUS B):		C $ 5,236.00
27 (NEXT YEARS CAPITAL COST OF RETAINING PRESENT EQUIPMENT)		
28 RESTORATIVE REPAIRS $ 1,500.00 / 5 YEARS EFFECTIVE + (RESTORATIVE REPAIRS $ 1500 × 6%)		D $ 390.00
29 RESALE, SALVAGE OR CONVERSION VALUE OF PRESENT EQUIPMENT $ 1,000.00 × 6%		E $ 60.00
30 SALVAGE VALUE LOSS, NEXT YEAR		F $ 200.00
31 TOTAL NEXT YRS. COST FOR PRESENT EQUIPMENT (C + D + E + F)		G $ 5,886.00
32 TOTAL NEXT YRS. COST FOR PROPOSED EQUIPMENT CHART 14% + INT. 6 % TOTAL 20 % × EST. COST INSTALLED $ 14,948.00		H $ 2,989.60
33 FIRST YEARS GAIN (+) OR LOSS (−) THRU REPLACING PRESENT EQUIPMENT (G-H) (TAKING INTO ACCOUNT DEPRECIATION, LOSS OF EFFICIENCY AND 6 % RETURN ON INVESTMENT) PLUS		$ 2,896.40 *

APPROVED BY: _____ DATE: _____ CALCULATED BY: W. F. Huyett DATE: 9/15/56

"Textile Machine Works is serving an industry that is passing through some very difficult times. To be of assistance and at the same time be competitive in our other lines, it is imperative that we keep our equipment modern and constantly strive to improve methods. Following closely to this policy, prices on the end product can be held in line."

W. S. SMITH
Equipment Director
Textile Machine Works
Reading, Pennsylvania.

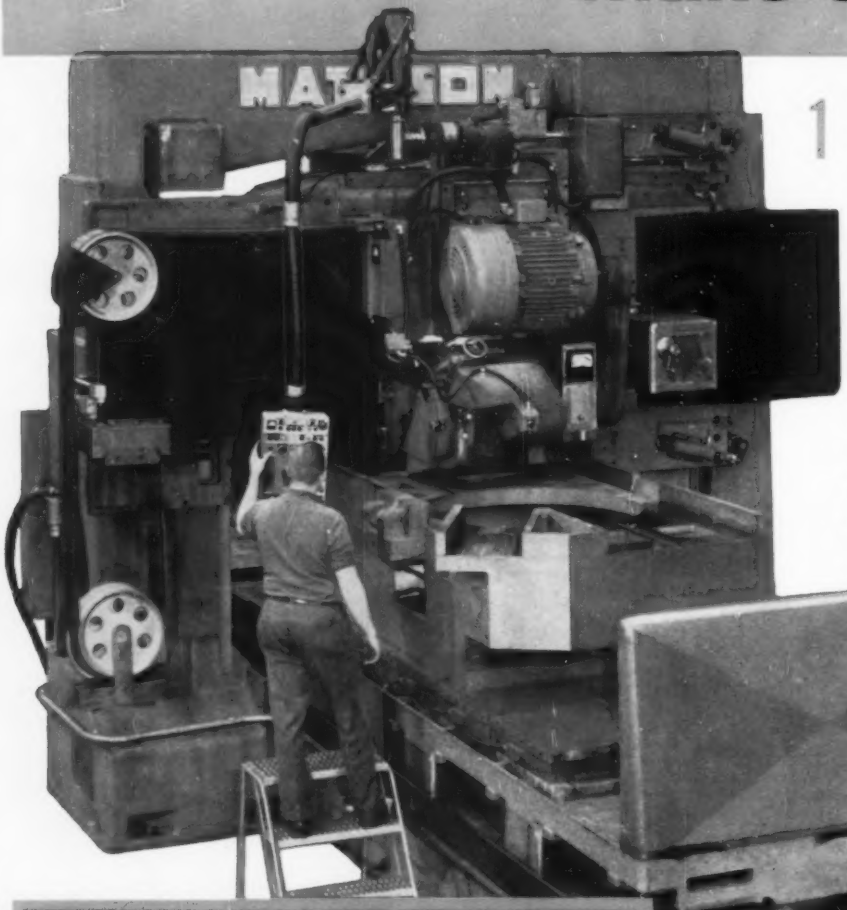
*** GAIN from replacement under the MAPI method is . . . After the return on the new investment . . . After allowance for future obsolescence of new equipment.**

August, 1958

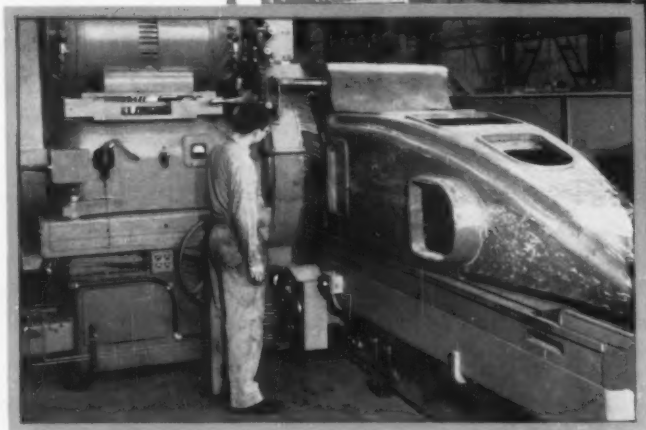
Keep gathering metal working production ideas . . . be well informed when you replace machinery . .

ROCKFORD INSERT GROUP

These MATTISON "GIANTS" make surface



1 Here is the *all-new Mattison Plano Surface Grinder*, which gives you extreme accuracies at all positions on the table (up to 60 in. wide) for precision-grinding large die plates, machine tool ways, and aircraft industry dies. To achieve maximum accuracy, the main support for the cross rail has been centered in the heavy ways on two sides of the main upright. Complete pendant control is provided for all machine functions. Hydraulic power provides both traversing or jump feed in increments ranging from ½ to 4 in. For grinding shoulders, micrometer cross-feed in increments of .001 or .002 can also be set at the pendant. Vertical feed can be set in increments of .001, .002, or .0002 and actuated by pushbutton or automatically.



2 **Model 900SS Face Grinder** is designed to pull 150 hp through the 48 in. segmental wheel (8 x 3 in. face), and is capable of withstanding 100 per cent overloads for brief periods in taking roughing cuts up to ¼ of an inch on the high spots of castings. Horizontal or vertical magnetic chucks assure positive holding and quick positioning of large pieces machined in a series of fast, *big* cuts.

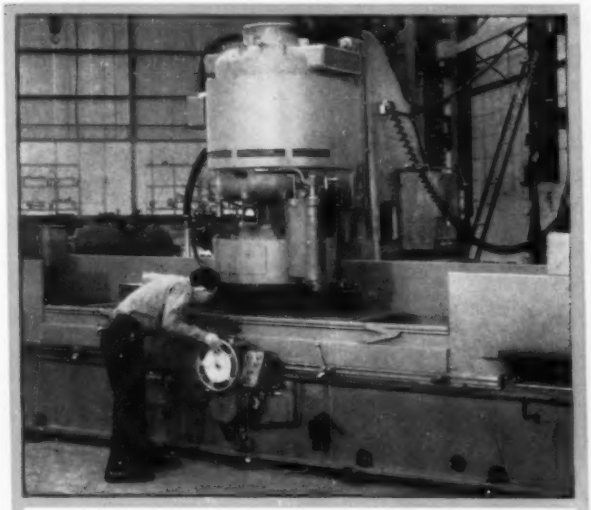
with stepped-up horsepower grinding more profitable!

NOW . . . MACHINE LESS METAL, SPEED LOADING AND UNLOADING, CUT THROUGH TOUGH SCALE FAST AND EASY

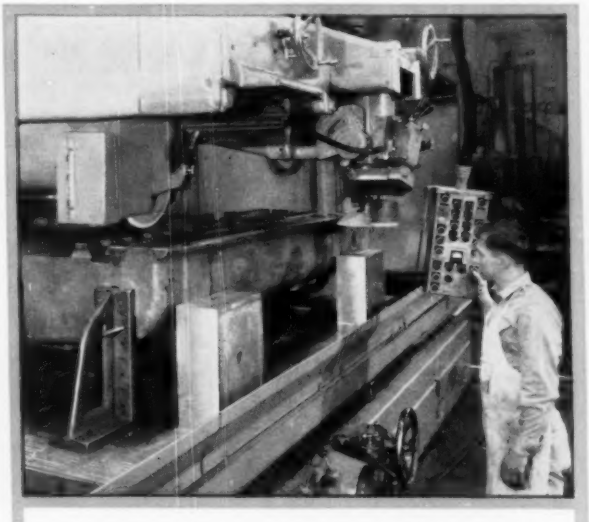
These Mattison machines combine large size with tremendous horsepower not usually associated with grinding, and make possible major savings in machine time and time of skilled operators. Now, large pieces can be set up on magnetic chucks and ground in less time than it ordinarily takes to locate them and clamp them in a fixture. You can reduce the weight of large castings and minimize the amount of metal being removed because stock allowances need not be as great. On large production runs, material costs can be reduced substantially.

Think of what these grinders mean in terms of tool life and efficiency when machining tough forgings and castings from the rough. They take these cuts in stride, getting under scale and removing a sizable amount of stock in a single pass. Hard spots have little effect on the wheel. Accuracy goes up, too. Large, uninterrupted surfaces can be ground using minimum wheel clearance —finishing cuts can be taken with wheels set dead flat. Hardened ways can be ground to a flatness of split thousandths, and results compare favorably with the finest hand scraping. Hardened surfaces that cannot be scraped are ground easily.

Call your Mattison dealer and arrange to have sample parts ground in the Mattison Methods Laboratory.



3 **4008S Vertical Spindle Surface Grinder,** with 100 hp spindle motor, is designed for fast stock removal and precision production of elongated parts or full chuck loads of smaller castings. Extreme accuracy is possible because the table never overhangs the bed. Magnetic chuck enables parts to be positioned or released without time-consuming handling of bolts, clamps, etc.



4 **Combination Way and Surface Grinder** brings you a faster, more precise method for machining several surfaces in different planes in a single setup. Unique three-column design provides rigid support for the two spindles. You can take a variety of cuts, such as dovetails, contours, etc., holding accurate alignment between surfaces. All machine motions are easily controlled from the pendant.

MATTISON MACHINE WORKS ROCKFORD ILL. U.S.A.

HIGH-POWERED PRECISION SURFACE GRINDERS

If it's a flat surface, there's a Mattison grinder to "machine" it!

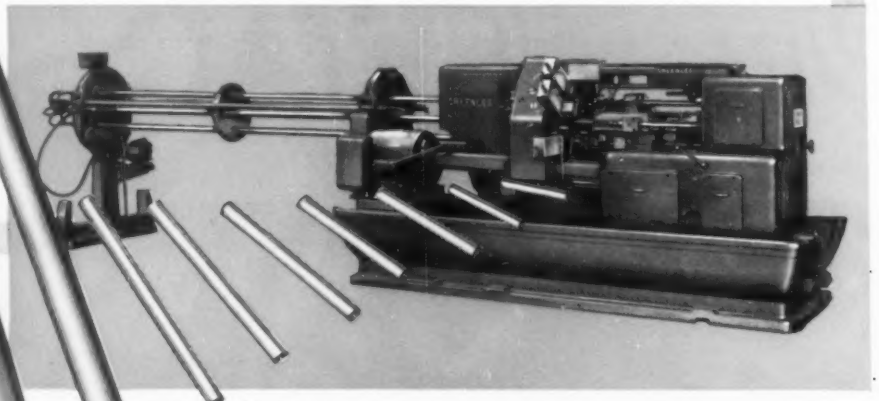
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

PRODUCTION MACHINERY

GREENLEE

AIR-FEED AUTOMATICS

Eliminate Stock Pushers...
Eliminate Scoring of Stock...
Provide For Extra Length Feed-Out...
Reduce Downtime During Set-Up



MULTIPLE FEED-OUT

Permits Greater Job Versatility and Added Profits

Greenlee Standard and Special Machine Tools

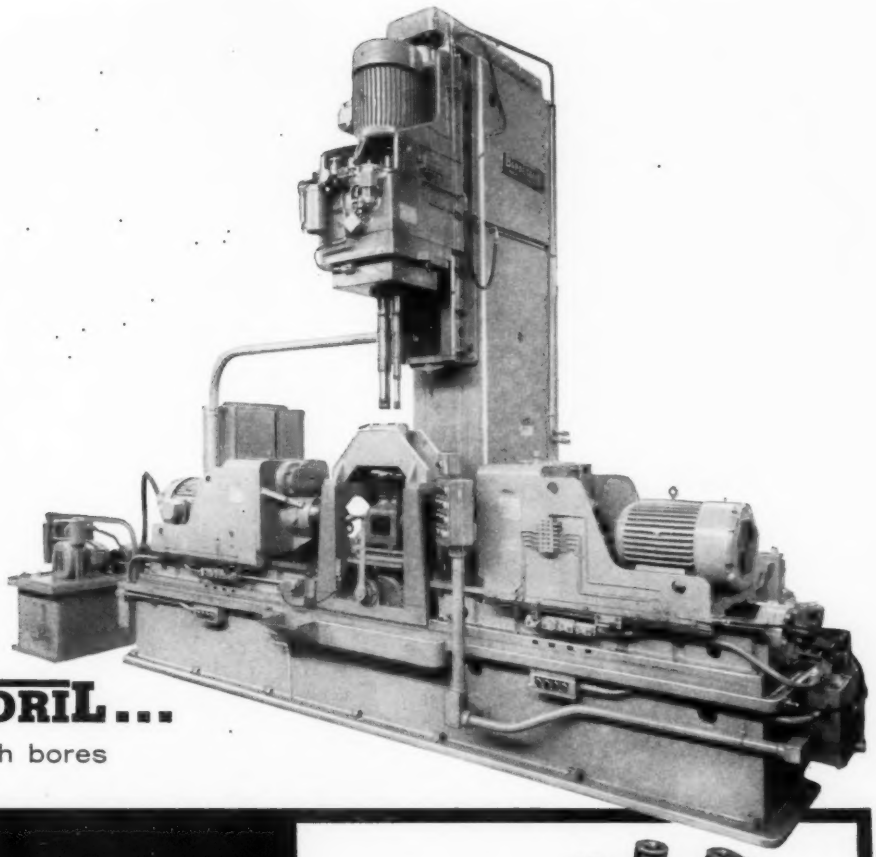
- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

Greenlee Air-Feed Automatics give you a competitive edge. The multiple feed-out arrangement offers a distinct profit advantage in machining many types of parts. Threads and oil grooves may be rolled on any portion of long shafts. Finish forming may be done on either end. See your Greenlee Distributor. He'll show you how Greenlee Air-Feed Automatics will pay off for you.

Write today for Catalog A-405 — first step on the way to more profitable production with Greenlee Automatic Bar Machines.

GREENLEE BROS. & CO.

1868 MASON AVE.
ROCKFORD, ILL.



BARNESDRIL...

rough and finish bores

10 different parts on one machine

These are samples of ten different crankcases, rough and finish bored on the same special Barnesdril 3-Way Unit Machine. This machine is engineered to handle all parts, using 2 fixtures with interchangeable top and lower plates. Machining flexibility is arranged through one single spindle adapter-type boring heads and five 2-spindle boring heads.

Such production flexibility furnishes a high rate of parts production, with minimum cost per part. Changeover part to part is simple and fast, either by changing complete fixture or substituting plates or spacers, with suitable boring heads. Machining *both* rough and finish bores of ten *different* parts on the one machine cuts direct labor and machine costs.

If you have parts requiring high speed automatic production, consult Barnesdril engineers for methods combining a number of different parts on a single machine. A full range of cycle operations are available, with cycle time engineered to meet production requirements. Send parts or prints for estimate.

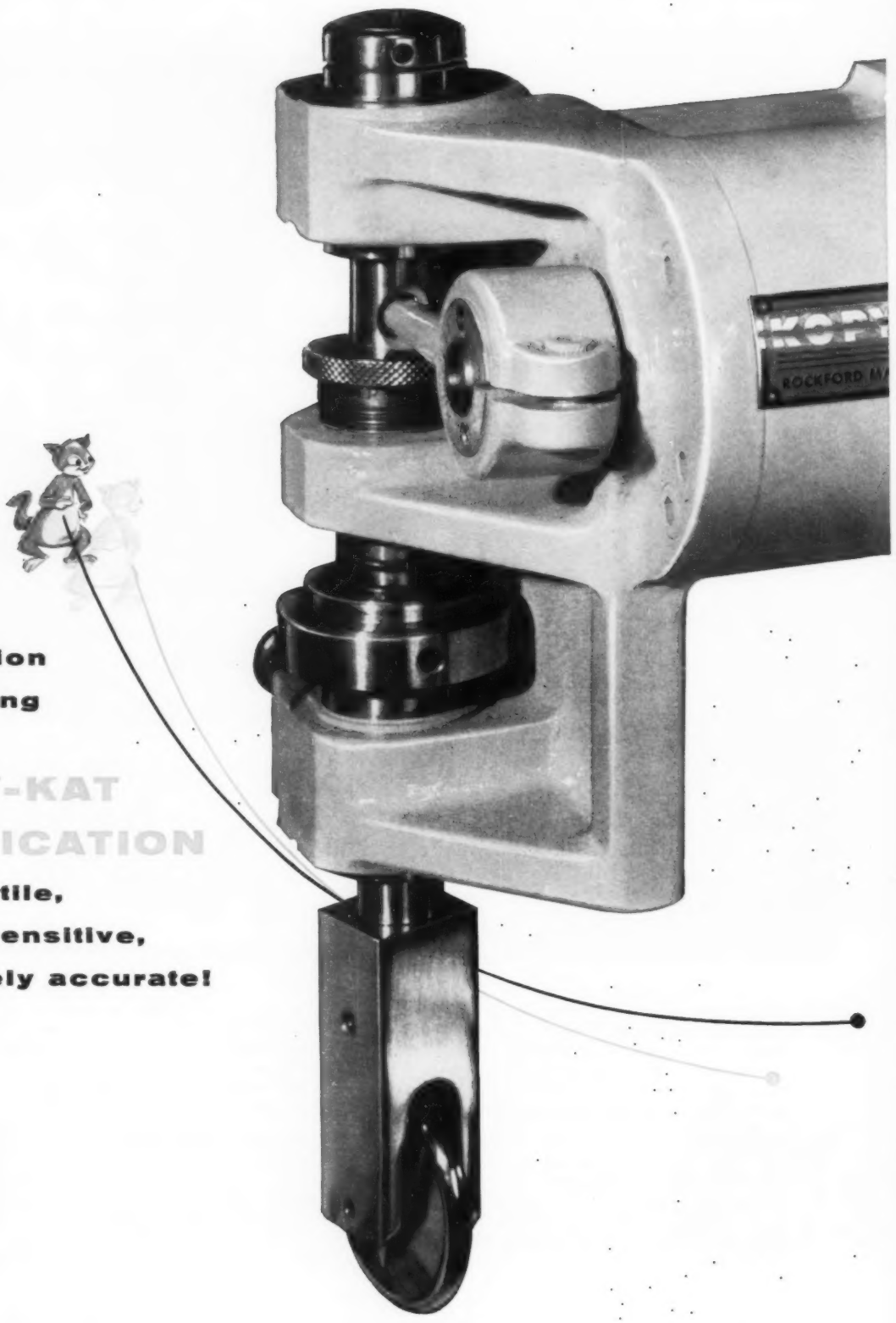
The facts are free... complete data on production flexibility obtained with Barnesdril special machines is found in this new Bulletin 1505. You may have a copy free upon request on company letterhead. Send for one today.

HOLE BARNESDRIL FINISHING

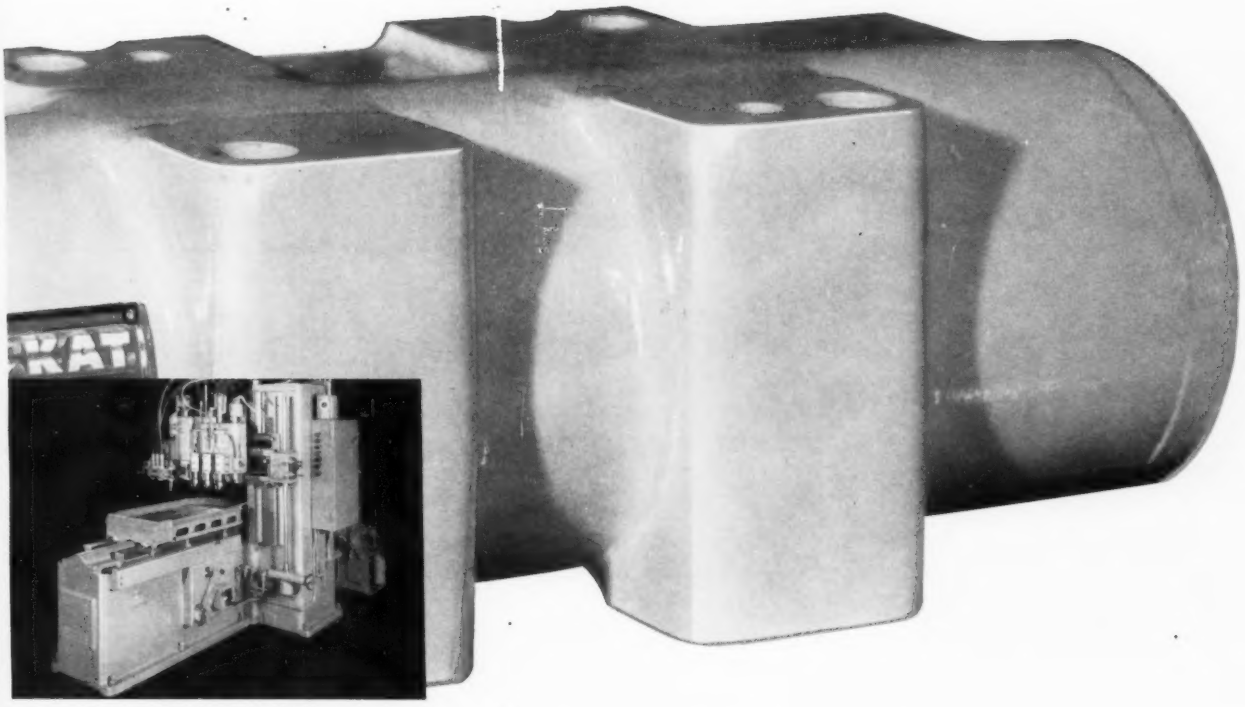
BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 13121 Puritan Avenue

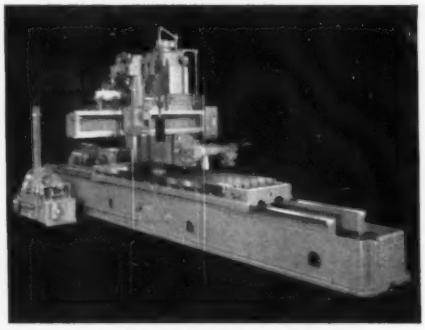
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



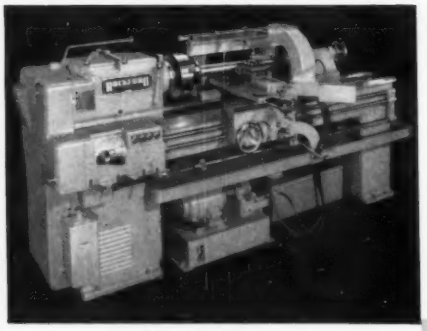
production
machining
with
KOPY-KAT
DUPLICATION
is versatile,
highly sensitive,
extremely accurate!



Hydraulic Openside Shaper



Hydraulic Openside Planer



Rockford Tracer Lathe

The versatility of the Kopy-Kat Duplicator is continually solving duplicating problems in many production machining shops. Its amazing sensitivity, power and precision, coupled with the efficiency of Hydraulic Shapers, Planers, Slotters, Shaper-Planers . . . . and Lathes, saves many hours in set-up and production time.

Kopy-Kat Duplication is direct hydraulic transfer with no intermediate motions, completely automatic, and as a result chances for error or irregularities in the final work are greatly reduced.

The Kopy-Kat Duplicator is specifically engineered for application on Hydraulic Shapers, Planers, and Slotters, and it becomes an integral operating part of any machine on which it is installed. Form tolerances are precisely held through the sensitivity of the Kopy-Kat selector valve.

When you are considering form machining, be sure to check all of these advantages on a Kopy-Kat equipped machine.

get the facts . . .

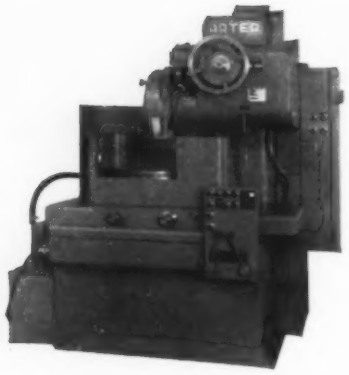
completely described in this new Bulletin 1300. Request on your letterhead will bring you a reply promptly.

A new motion picture film "The Rockford Kopy-Kat" is also available through your local distributor.

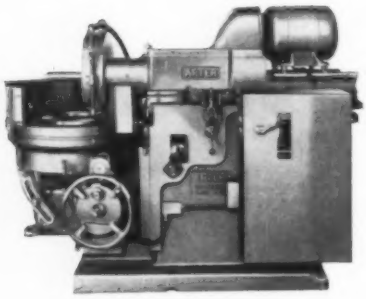
HYDRAULIC

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

Announcing the SUNDSTRAND-ARTER Grinder Division



MODEL E HYDRAULIC vertical column rotary surface grinder has reciprocating table and rotating magnetic chuck with 12" and 16" capacities.



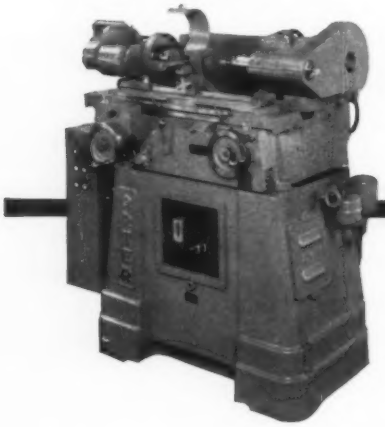
ROTARY SURFACE GRINDER, Model B, is available in four chuck sizes: 20", 24", 30", and 40". Hydraulic motor provides stepless variable speeds to tiltable work table.

Newest additions to the growing line of Sundstrand machine tools are rotary surface grinders, cylindrical grinders, and Jigmatic electronic tape-controlled positioning table — all products of the Sundstrand-Arter Grinding Division. These products — already enjoying an industry-wide reputation for quality and precision — now have the additional backing of Sundstrand facilities and resources.

The same awareness of industry's production needs, interpretation by skilled machine designers, and adherence to the highest standards of manufacturing accuracy that have always distinguished Sundstrand machine tools will be applied to products of the Sundstrand-Arter Grinding Division.

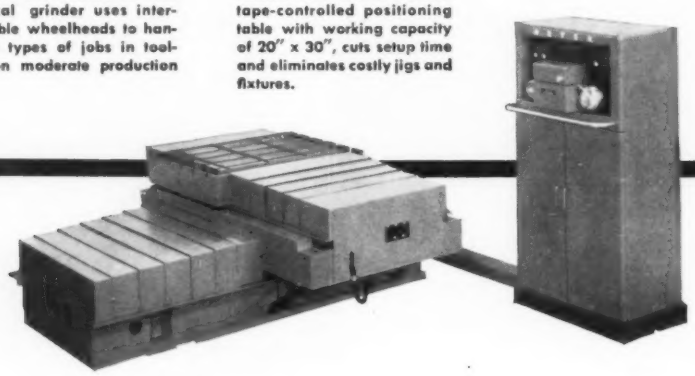
On these pages are shown four examples of Sundstrand-Arter equipment, as well as representative types of milling, turning, broaching, and special machines built by Sundstrand.

Not shown, but equally important to you, is Sundstrand "Engineered Production" — the application of years of design and manufacturing engineering skill to your specific needs. It's another plus you get from Sundstrand to assure maximum machine productivity at minimum cost per piece.



DUAL-PURPOSE internal-external cylindrical grinder uses interchangeable wheelheads to handle both types of jobs in toolrooms on moderate production runs.

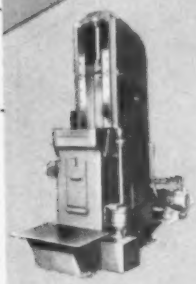
JIGMATIC ELECTRONIC tape-controlled positioning table with working capacity of 20" x 30", cuts setup time and eliminates costly jigs and fixtures.



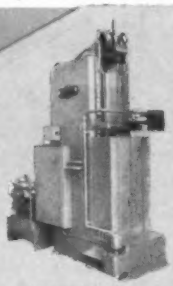
MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.

Are your lathes designed to profit

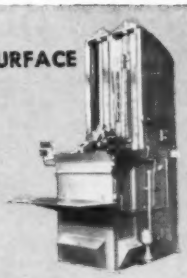
BROACHING



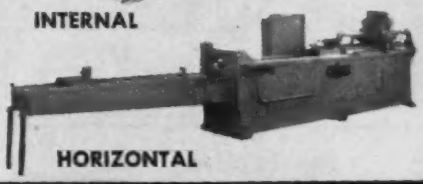
3-WAY



INTERNAL

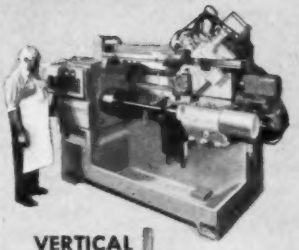


SURFACE

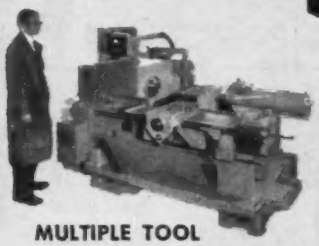


HORIZONTAL

TURNING



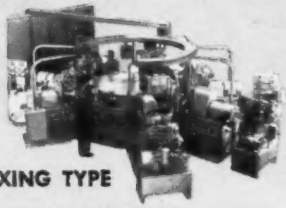
TRACER



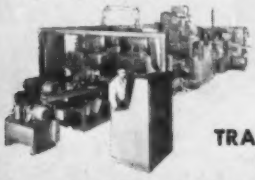
MULTIPLE TOOL

VERTICAL

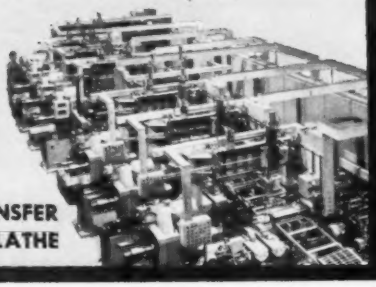
SPECIAL MACHINES



INDEXING TYPE

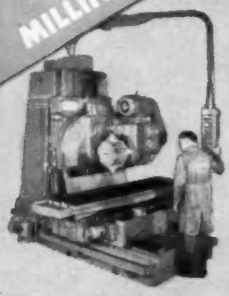


TRANSFER MACHINE

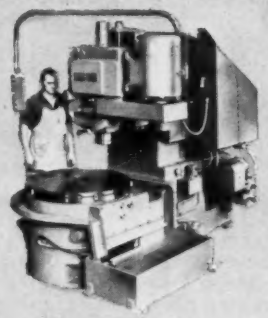


TRANSFER LATHE

MILLING

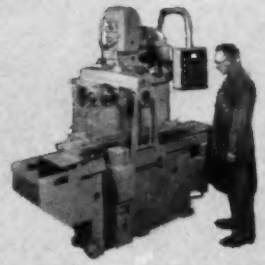


OMNIMIL

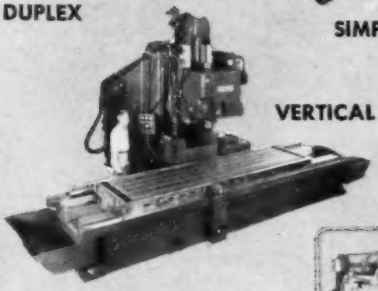


ROTARY

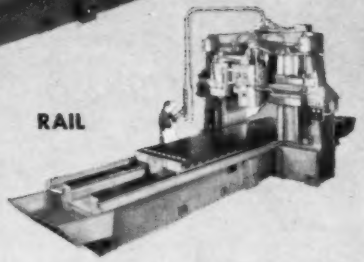
DUPLEX



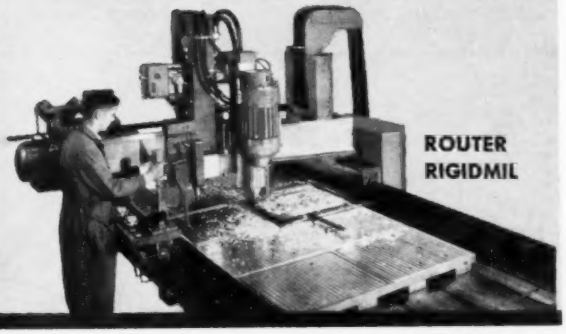
SIMPLEX



VERTICAL



RAIL



ROUTER RIGIDMIL

SUNDSTRAND MACHINE TOOL CO.

SUNDSTRAND

2530 ELEVENTH STREET • ROCKFORD, ILLINOIS

Are your lathes designed to profit from throwaway insert tools?

PROFIT POINT TURNING

Real profits come from decreased tool-change downtime and increased machine speeds

You can take full advantage of the savings made possible by throwaway insert tooling — elimination of sharpening and resetting costs, and decreased tool-change downtime — if you have a modern, high-speed lathe designed for carbides and ceramics. Chances are savings in tool-replacement costs plus greater production due to higher speeds and increased rigidity will amount to thousands of dollars a year, enough to pay for the new lathes you need badly to take full profit advantage.

The use of conventional speeds with throwaway insert tools is *wasteful*. And your profits are pegged *low* if you're using them on 20-year-old lathes that are underpowered for high-velocity turning. With perishable-tool costs so low in comparison with the cost of operating a lathe, the only sensible thing to do is boost machine speeds . . . burn up the cutting tool faster . . . really trim the fat out of the part price.

The speed at which tool costs and machining costs are in balance is your PROFIT POINT (see example above). But to operate at the right speed you need power, precision, and rigidity in lathes used with throwaway insert tooling — advantages your company will be glad to pay for in order to save time, floor space, and cost.

In other words, why put throwaway insert tooling on a "throwaway profit" machine tool?

Example of PROFIT-POINT Turning

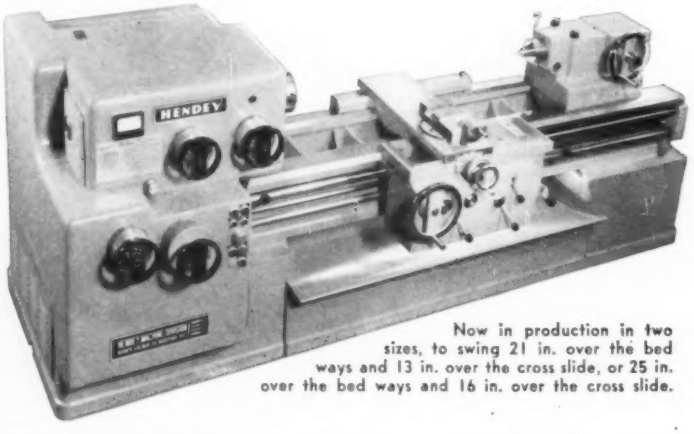
Cost Item	Brazed Carbide	Throwaway Insert
Tool-change time	5 min.	2 min.
Cost per cutting edge	$1.27	$.25
Minimum cost tool life	40.4 min.	11 min.
Cutting speed for PROFIT-POINT turning	720 fpm 1000 rpm	980 fpm 1360 rpm
Machining time per piece	1 min.	.74 min.
Total time per piece (including nonproductive time per piece)	2 min.	1.74 min.
Machining cost per piece	$.15	$.11
Total cost per piece	$.031	$.017
Nonproductive cost per piece	$.15	$.15
Pieces machined per hour	30	34
TOTAL COST PER PIECE	$.331	$.278

Barber-Colman's new 36-speed lathe is designed for PROFIT-POINT turning

Here's the machine that will give you precision work at the high speeds required for PROFIT-POINT turning with throwaway insert tools!

Look at the cross girth of the bed, extra-heavy cross slide, and rugged tailstock. Consider that this lathe will pull up to 25 hp through the spindle and operate at speeds up to 2000 rpm — yet you can get toolroom accuracy. And all the toolroom features, too, including: (1) multiple-thread indexing spindle, (2) built-in thread-chasing dial, (3) 66 threads, from 2 to 120 per inch, (4) reverse lever on apron, (5) automatic micrometer stops, (6) ball-thread-chasing stop on cross-feed screw, (7) hardened and precision-ground cross-feed screw and compound screw, (8) automatic, filtered lubrication to half nuts.

There are 36 spindle speeds through the geared head and 66 feed and thread changes, selected easily through two dials on the headstock. Write for complete facts on how this new Barber-Colman precision lathe will pay for itself quickly with throwaway insert tooling.



Now in production in two sizes, to swing 21 in. over the bed ways and 13 in. over the cross slide, or 25 in. over the bed ways and 16 in. over the cross slide.

Barber-Colman Company
82 Loomis Street, Rockford, Illinois

Don't expect a day's work for a day's pay on yesterday's machine tools

BARBER COLMAN ®

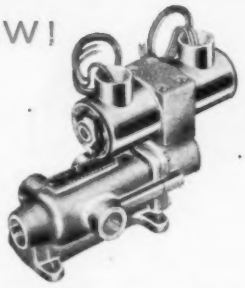
PRECISION LATHES

SCHRADER ADDS MORE NEW AIR CONTROL PRODUCTS TO GIVE YOU EVEN WIDER SELECTION

NEW!

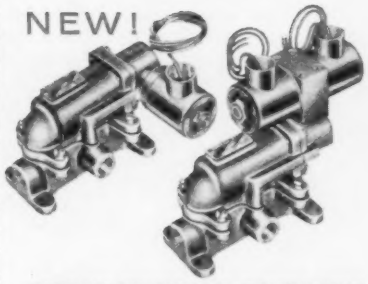
HOSE REEL FOR AIR TOOL SUSPENSION —Saves duplicate equipment and maintenance. Saves time on high speed production. Spring tension counterbalances air tools. Powerful spring automatically takes up tool.

NEW!



DOUBLE SOLENOID 4-WAY VALVES — Now double solenoid 4-way action available in full series . . . voltage-wise, port size, flow capacity. Permits longer dwell time in either position without continuous electrical energy.

NEW!

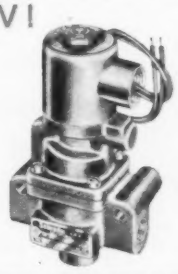


SUB-BASE SINGLE AND DOUBLE SOLENOID VALVES — Greater versatility. You don't have to disturb the piping for service. Reduces "down time" to absolute minimum. Complete series: voltages, sizes, capacities.

NEW!

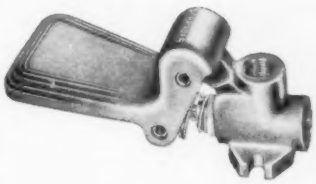
PILOT OPERATED SUB-BASE 4-WAY VALVES — Sturdy cast meehanite sub-base contains all ports for piping air. Permits removal of valve mechanism for service without disturbing piping. Complete new series!

NEW!



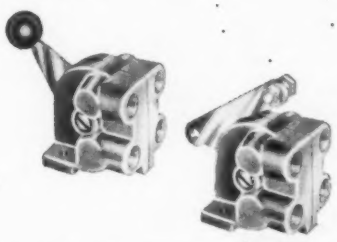
NEW! 3-WAY SOLENOID VALVES—Simple 3-way action available in full series—voltage, port sizes, flow capacities. By shifting pilot chamber head 90°, normally open changes to normally closed, and vice versa!

NEW!



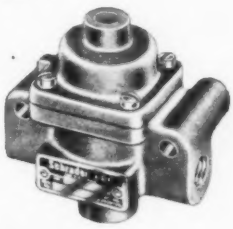
2- AND 3-WAY FOOT VALVES — With right angle ports. Give convenience and control with simplest installation. Mount directly on floor. ⅜" N.P.T. Sturdy, compact, and *versatile*. Take minimum space.

NEW!



SLIDING SEAL VALVES FOR PIPED EXHAUST — Complete series! 2, 3, 4-way types. ¼" N.P.T. ports. Hand or mechanical lever. Compact, minimum working parts.

NEW!



3-WAY PILOT VALVES — Complete new line. Normally open or normally closed types. Ideal for single-acting cylinders. Simple, neat, sturdy. May easily be converted to solenoid.

NEW!

CHECK VALVES—Thread combinations now in complete series in spring-loaded check type. Pinpoint your needs. Amazingly compact, relative to large flow capacity. Capacity 35 cu. ft.

Schrader®
a division of SCOVILL

Use the full Schrader line to do your air control selecting. Your Schrader distributor can help you pinpoint what you need. For more data write:

A. SCHRADER'S SON • *Division of Scovill Manufacturing Company, Incorporated*
454 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR PRODUCTS

For more information fill in page number on Inquiry Card, on page 161

PRODUCING

LE MAIRE

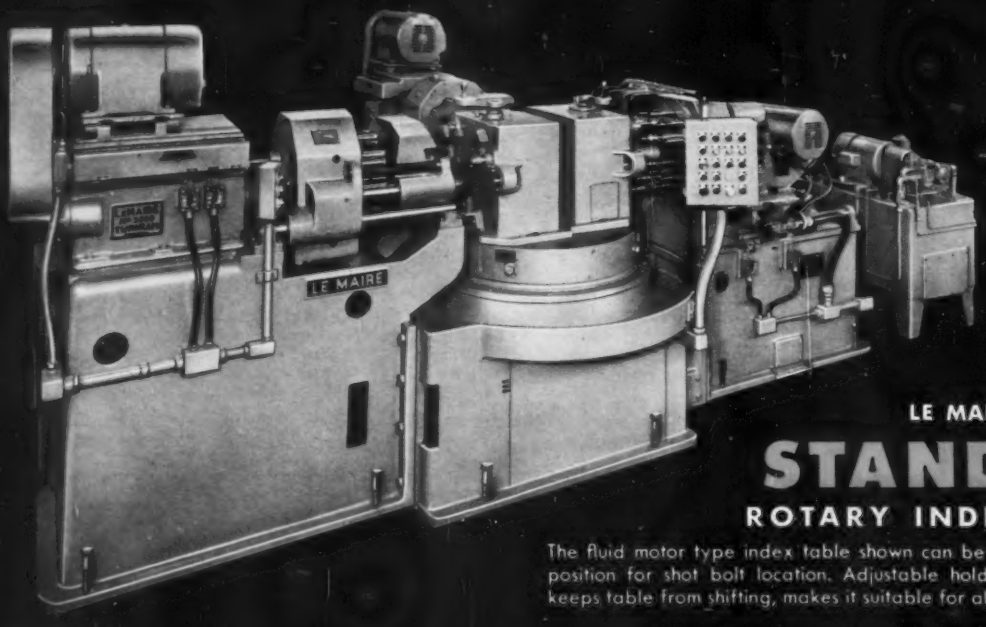
STANDARD
MILLING HEAD UNITS

Vertical milling head cleans up mounting face of oil pump covers. Other operations on this machine include drilling and reaming. Production is 90 parts per hour at 100% efficiency.

LE MAIRE

STANDARD
DRILLING UNITS

Multiple tooling on standard units performs drilling, reaming, counterboring and tapping of 75 flywheels hourly. While units shown are quill type, LeMaire also manufactures standard way type units.



LE MAIRE

STANDARD
ROTARY INDEX TABLES

The fluid motor type index table shown can be set to stop in exact position for shot bolt location. Adjustable hold-down arrangement keeps table from shifting, makes it suitable for all types of machining.

with LE MAIRE

STANDARD BUILDING BLOCKS

Give You Economy . . . Flexibility . . . Simplicity

Before you automate . . . *investigate* the complete LeMaire line of standard hydraulic power units. Each is practical, efficient, economical . . . and nearly as flexible in application as a standard electric motor!

These LeMaire "building blocks" are designed for interchangeable installation on a wide variety of standard bases. This allows low-cost unitized construction, in minimum lead time, of a "special" which solves *today's* production machining problem . . . and which can be economically converted or modified to meet *future* needs.

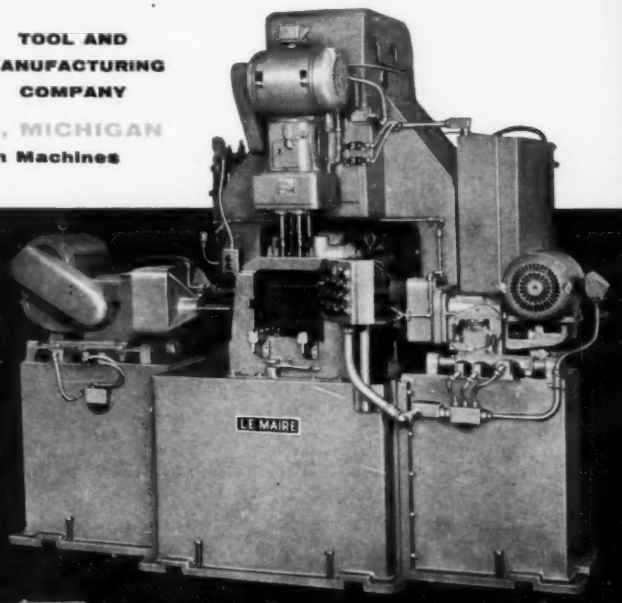
LeMaire standard units are suitable for drilling, boring, counterboring, reaming, spot-facing, tapping and milling. They operate in horizontal, vertical or angular positions. Infinite control of feeds is provided, along with construction which assures twist-free, straight line, uniform operation under all production conditions. All units are built to J.I.C. standards.

For practical, economical, flexible automation, check the possibility of using LeMaire "do-it-yourself" building blocks . . . or ask LeMaire engineers to recommend the right combination for your specific production machining problem. Send parts or prints for prompt recommendations.

LE MAIRE TOOL AND MANUFACTURING COMPANY

2657 S. TELEGRAPH ROAD • DEARBORN, MICHIGAN

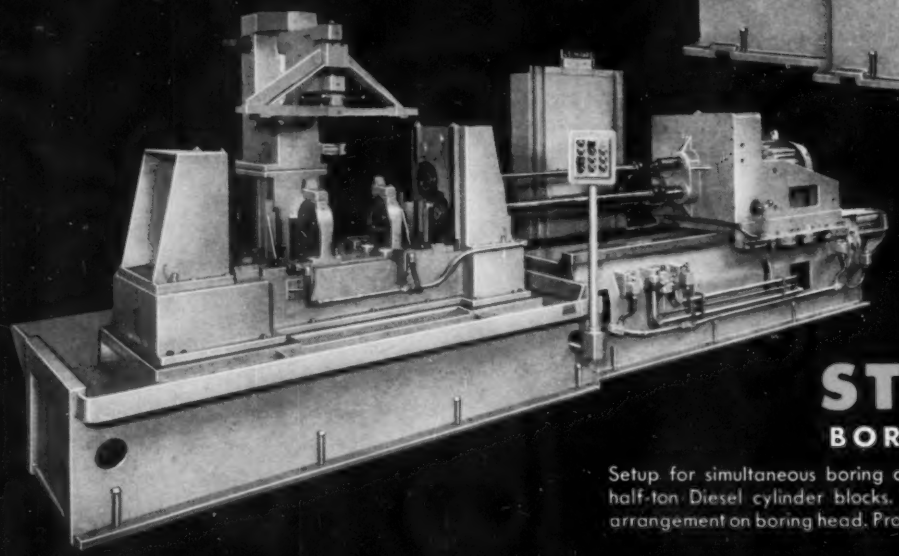
Designers and Builders of Special High-Production Machines



LE MAIRE

STANDARD LEAD SCREW TAPPING UNITS

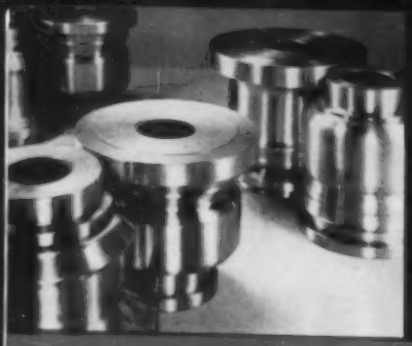
Four sides of farm tractor hydraulic reservoir are tapped at once by this machine, arranged with various size master lead screw tapping units. Production is 56 parts per hour at 100% efficiency.



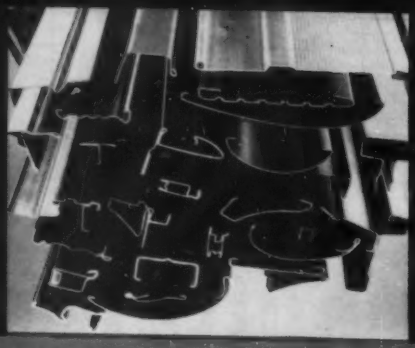
LE MAIRE

STANDARD BORING HEAD UNITS

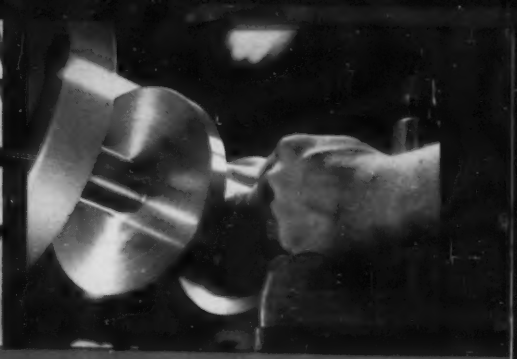
Setup for simultaneous boring of camshaft and crankshaft bores in half-ton Diesel cylinder blocks. Way type unit has tool positioning arrangement on boring head. Production is 9.4 cylinder blocks per hour.



▶ Turning 3 to 20-stage rolls that . . .



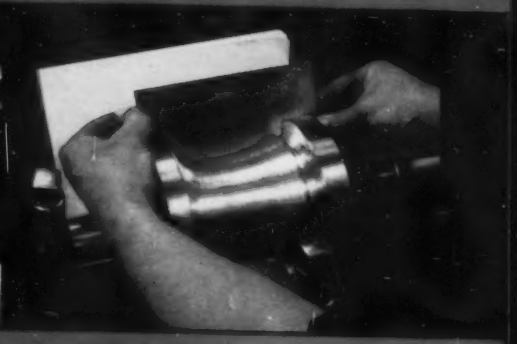
▶ form automotive trim-molding is . . .



▶ a one-of-a-kind job of craftsmanship . . .

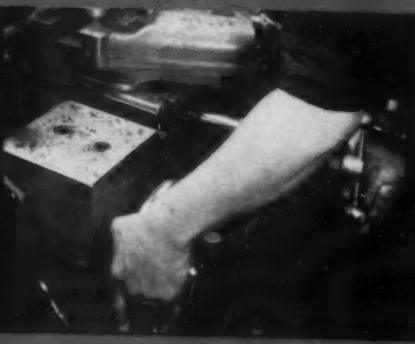
▶ checked . . .

▶ rescraped . . .



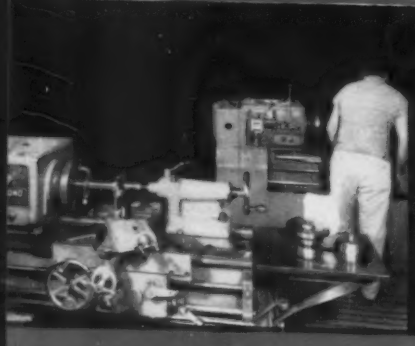
▶ and checked again . . .

▶ Lathe craftsmen like these need . . .

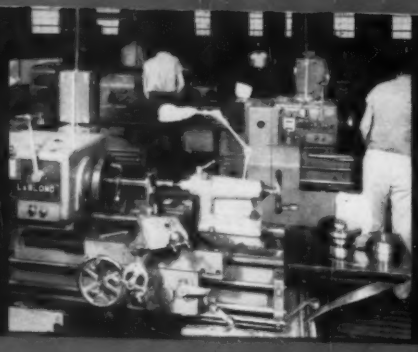


▶ smooth, responsive controls . . .

▶ simple, convenient speeds . . .

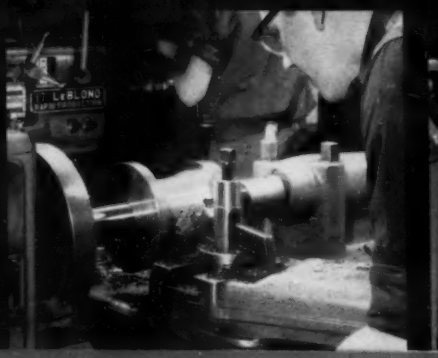


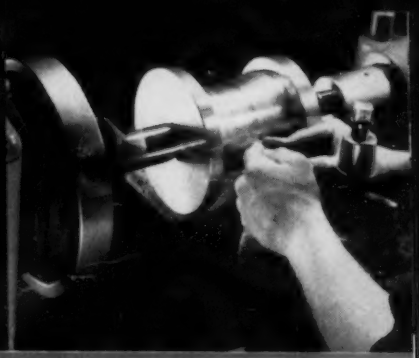
▶ bought 2 new LeBlond Rapid Productions . . .



▶ To work alongside their 3 LeBlond Dual Drives . . .

▶ while one other-make lathe sits idle!

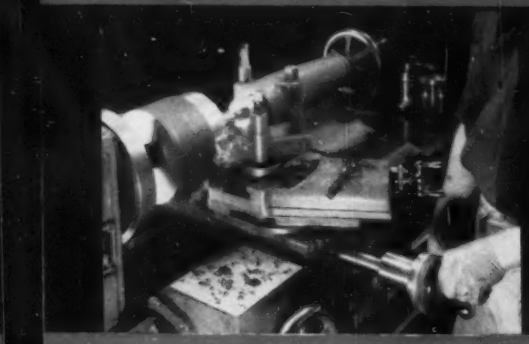


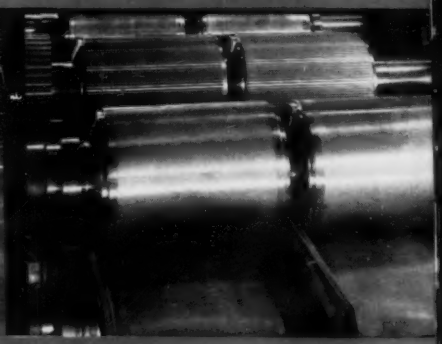


▶ First, females are roughed, then . . .

▶ turned to near-dimension . . .

▶ scraped with hand-held tool . . .

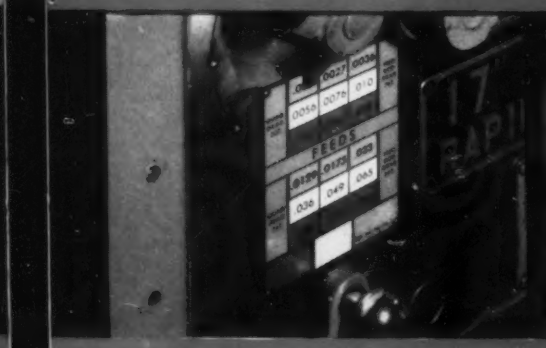


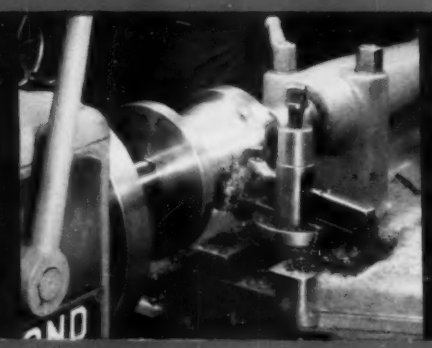


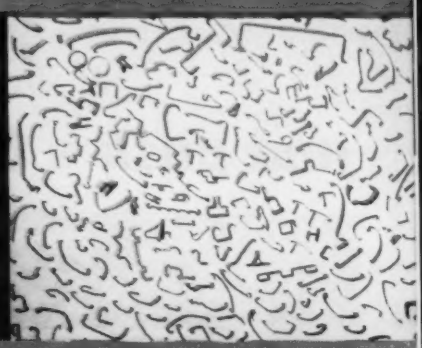
▶ Next, mating male is turned and scraped . . .

▶ checked with female using feeler gage . . .

▶ and final-checked in rolling mill . . .



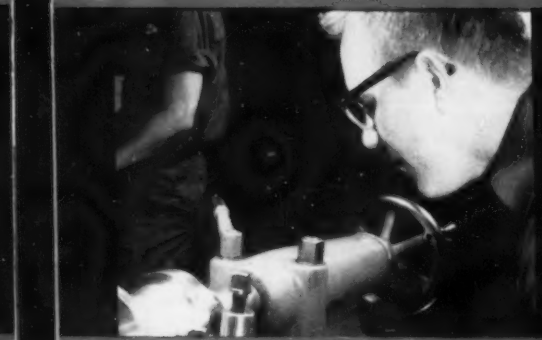




▶ and feeds . . .

▶ power, and rigidity that lasts.

▶ That's why Dexter Roll Form Co., Detroit . . .



The R. K. LeBlond Machine Tool Company

World's Largest Builder of a Complete Line of Lathes for More Than 71 Years

Cut with Confidence . . .

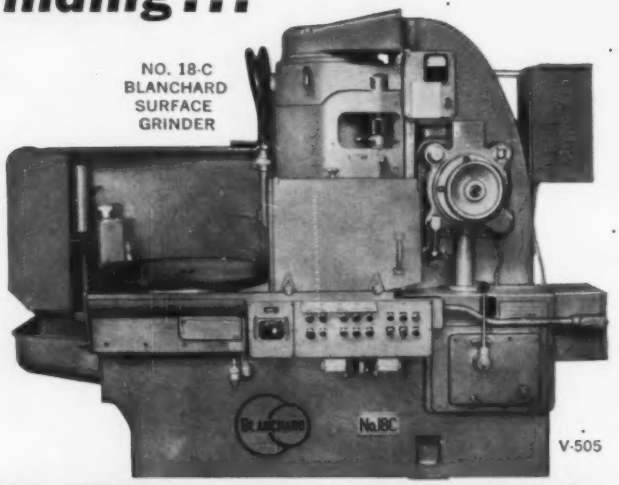
LeBLOND of Cincinnati

Cincinnati 8, Ohio

▶ Remember, with turning craftsmen. it's LeBlond. Ask them.

For better, easier grinding...

Whether you're "hogging" off stock from rough castings or precision grinding to a tolerance of ±.0005", you can do it better and easier with the Blanchard No. 18-C Surface Grinder. Once the work is set up, the automatic cycle handles every operation from start to finish. The operator is free to prepare the next load of work or to operate a second No. 18-C Grinder.



Cast Iron Plate. Blanchard ground at the rate of 30 pieces – 60 surfaces – per hour. Stock removal ⅛" each side.

Steel Bars. Blanchard ground at the rate of 48 pieces – 192 surfaces – per hour. Stock .040"-.045" from each side. Limits ±.001" square, flat and parallel.

Hot Rolled Steel Cams. One operator and one No. 18-C Blanchard produce 225 pieces – 450 surfaces – per hour. Stock removal 1/32" each side. Limits ±.001".

just push a button...

- Automatic size control to ±.0005"
- Duplication of repetitive loads
- Pre-set "spark out" time for flatness and surface finish
- No more "operator worry" on close work – greatly reduced fatigue
- A large part of operator's time available for
  - (a) Handling or slushing work pieces
  - (b) Filing burrs
  - (c) Selecting correct wheel and preparing for next job
- Specially-designed sizing device with built-in feature to compensate – automatically – for wheel wear during grinding cycle.

All of these features give you *more efficiency at reduced costs!*

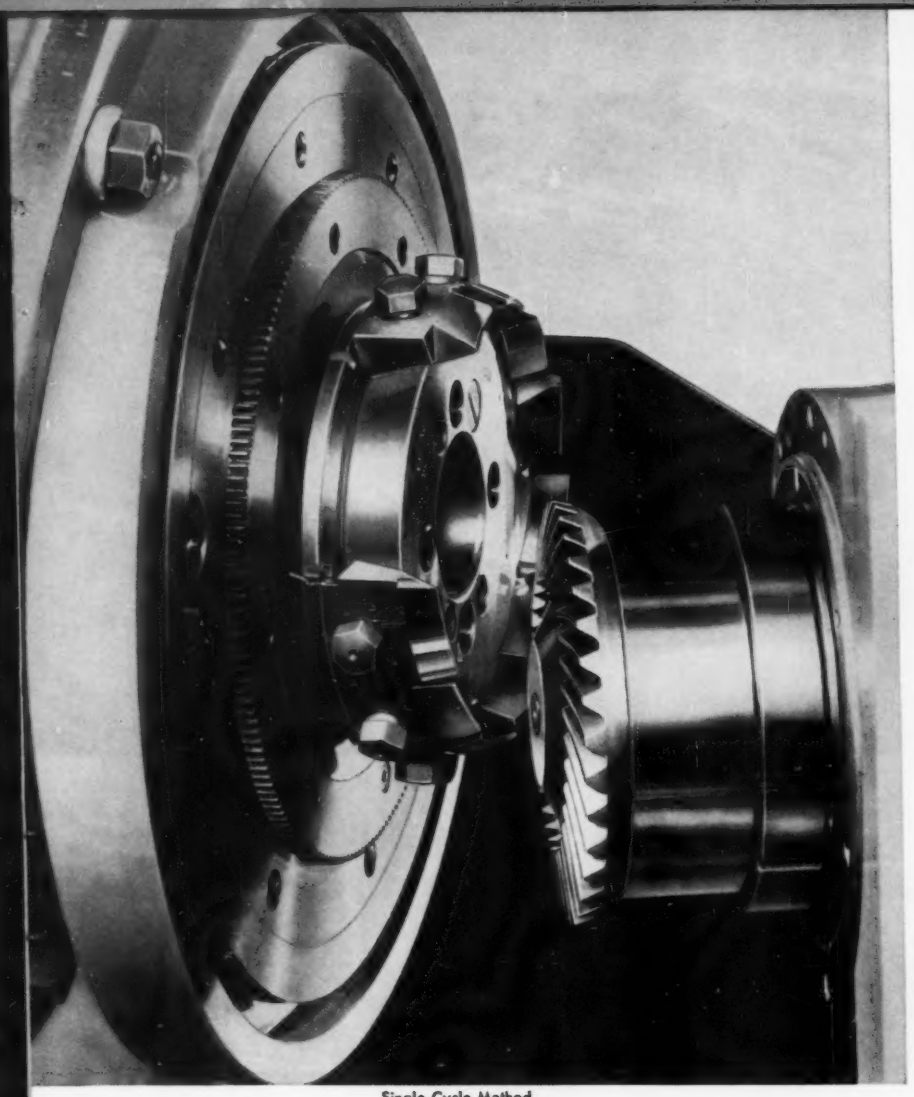
PUT IT ON THE BLANCHARD

Send for your free copy of Model 18-C folder.

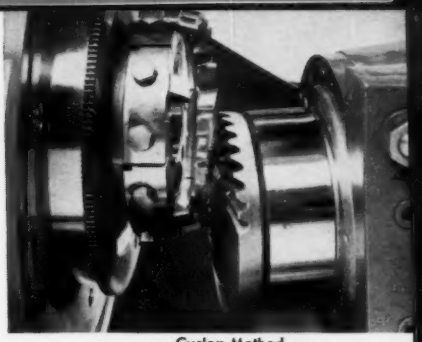
THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

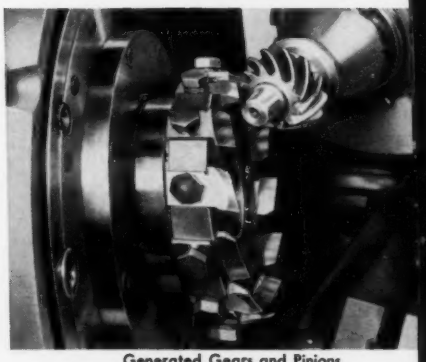
For more information fill in page number on Inquiry Card, on page 161



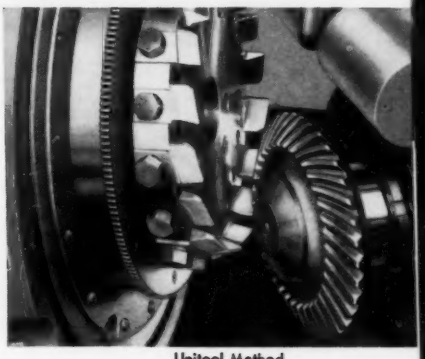
Single Cycle Method



Cyclex Method



Generated Gears and Pinions



Unitool Method

Cut gears with *four* different methods on *one* machine

If you expect your gear needs to change over the years you'll appreciate the exceptional versatility of the Gleason No. 108 Hypoid Generator. With this one machine you can cut both gears and pinions by four different methods:

Single Cycle® Method. Using this method you can cut nongenerated gears four to five times faster than previously possible on machines of this type. Cradle and work head are locked in position. The last rotation of the Single Cycle Cutter finishes both sides of a tooth space. You cut the mating pinions on the same machine using the conventional single-roll Generating Method.

Cyclex® Method. For certain applications you can use the extremely fast Cyclex Method on the No. 108 Generator. You cut nongenerated gears in one completing operation from the solid blank.

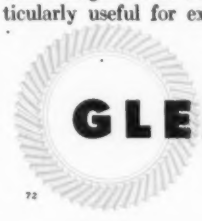
Generated Gears and Pinions. You can produce both gears and pinions on this machine with the Generating Method. Here, a relative rolling motion takes place between gear or pinion and the rotating cutter.

Unitool* Method. If you want to cut small quantities of spiral bevel, Zerol® bevel, or hypoid gears with a minimum of tooling, you can use the Unitool Method. You cut both gears and pinions with a single cutter. This method is particularly useful for experimental gears for prototype work.

The No. 108 Generator cuts gears up to 8½" diameter at a 10:1 ratio and to a maximum of 4 DP. You can get the same versatility in cutting larger gears with the No. 118 Hypoid Generator which handles gears up to 18" diameter, 10:1 ratio, to a maximum of 2 DP. A third model, the No. 29 Hypoid Generator, cuts gears up to 33" diameter at 10:1 ratio, 1½ DP.

Send for free bulletins on all three machines.

*Trademark

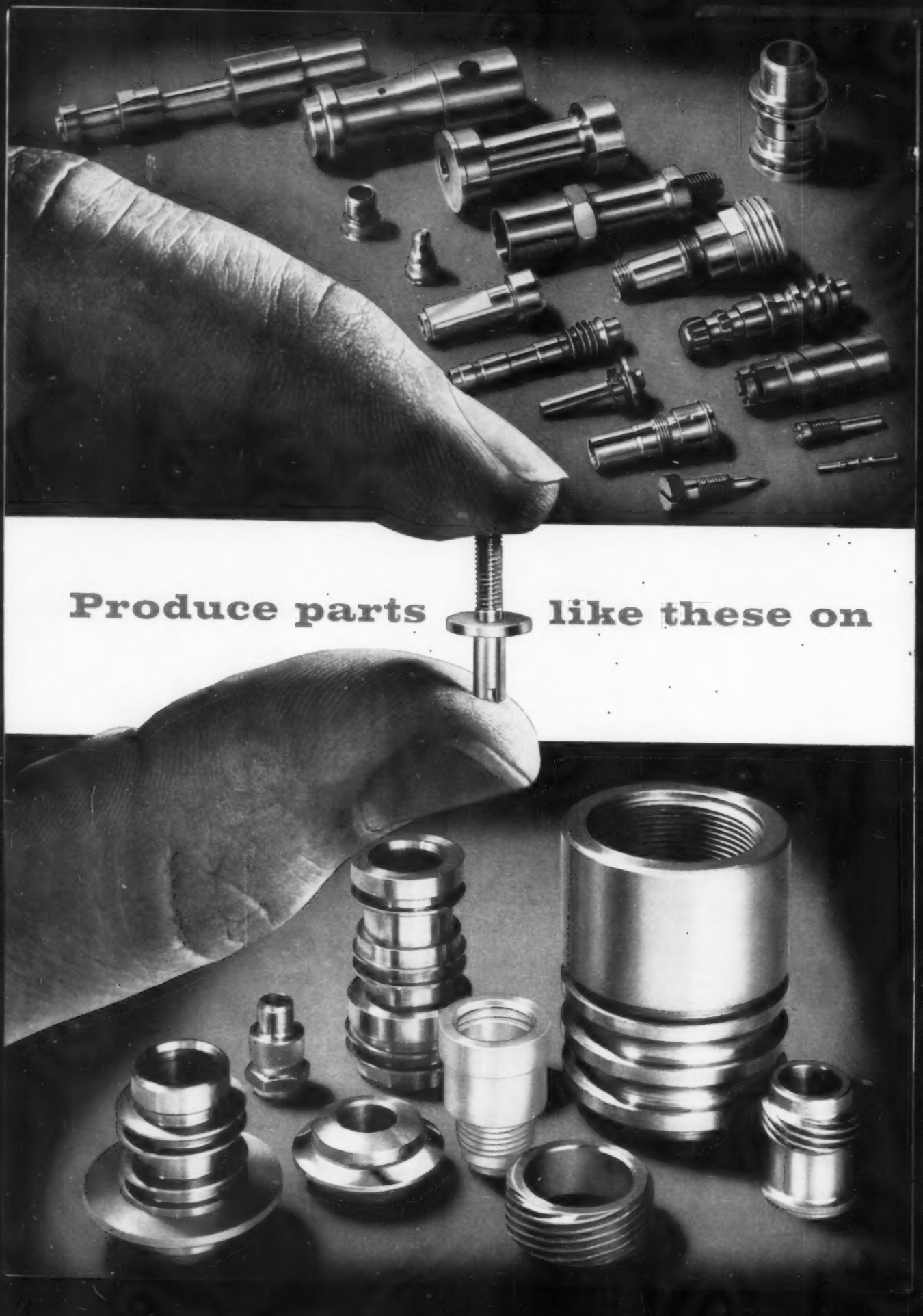


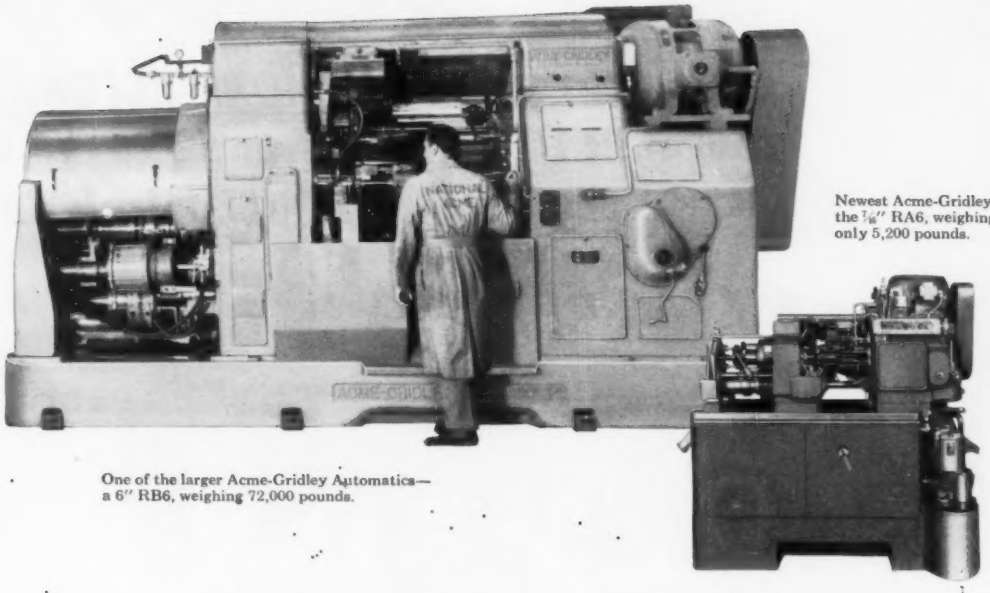
72

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.


Produce parts like these on



Newest Acme-Gridley—the 7/8" RA6, weighing only 5,200 pounds.

One of the larger Acme-Gridley Automatics—a 6" RB6, weighing 72,000 pounds.

ACME-GRIDLEY automatics . . .

FORGET SECONDARY OPERATIONS!

Most parts machined on Acme-Gridleys are *completed* on Acme-Gridleys. Using these Automatics, you eliminate costly rehandling and, in many instances, avoid a sizeable second-machine investment.

The advantage applies to parts weighing fractions of ounces or hundreds of pounds. And the wide-open tooling zone of every Acme-Gridley lends itself to a broad range of installations limited only by the tool engineer's ingenuity. It means that, for sheer capacity range, no line of automatic production equipment in the world equals Acme-Gridley.

If you produce parts like the ones illustrated, then Acme-Gridley Automatics must be in your present plans. Our representative can give you expert assistance without obligation.

National Acme

THE NATIONAL ACME COMPANY, 179 E. 131st ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N.J., Chicago 6, Ill., Detroit 27, Mich.

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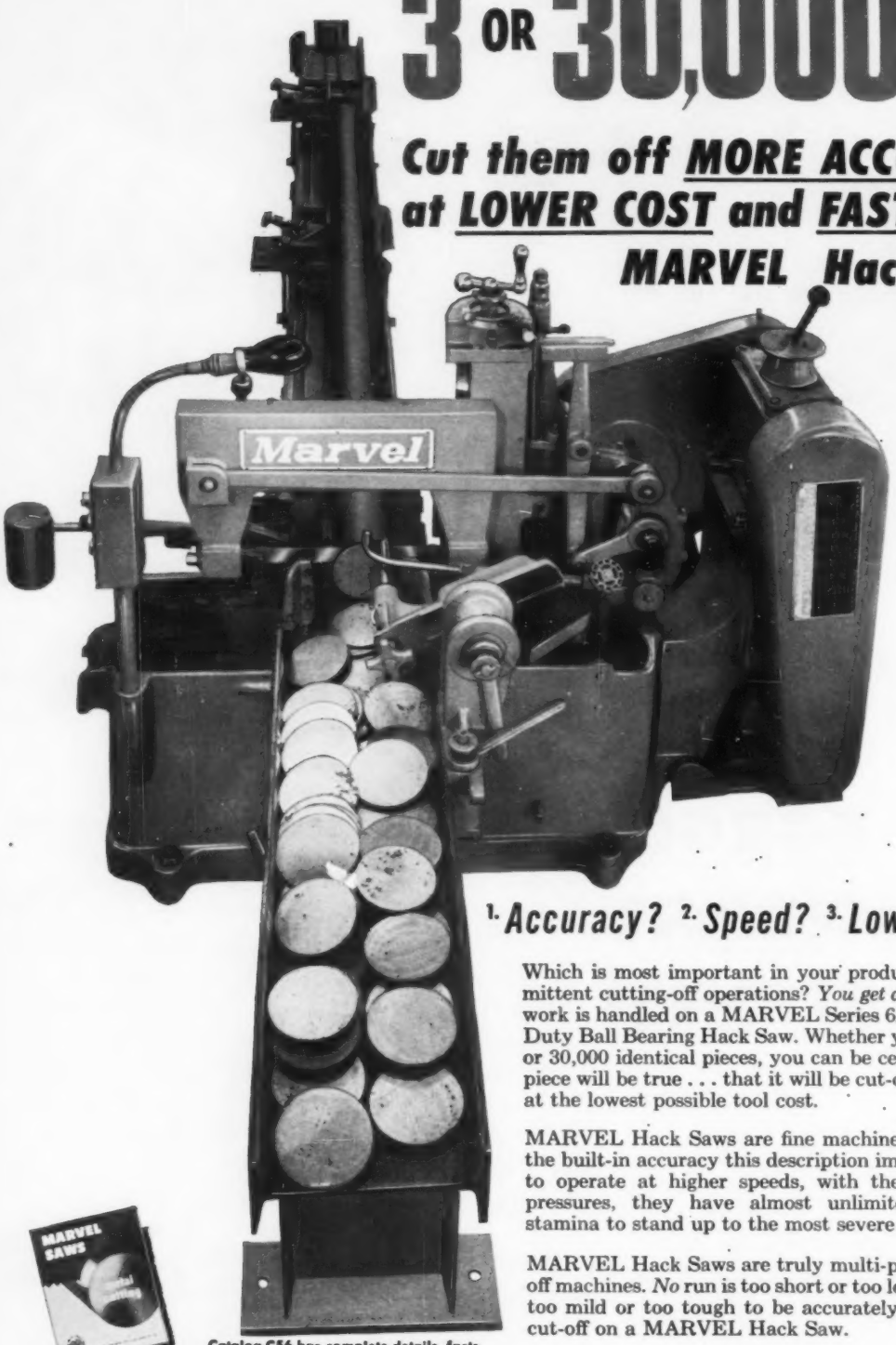
3 OR 30,000 PIECES

Cut them off MORE ACCURATELY at LOWER COST and FASTER on a MARVEL Hack Saw



1. Accuracy? 2. Speed? 3. Low Cost?

Which is most important in your production or intermittent cutting-off operations? *You get all 3* when your work is handled on a MARVEL Series 6A or 9A Heavy Duty Ball Bearing Hack Saw. Whether you're cutting 3 or 30,000 identical pieces, you can be certain that each piece will be true . . . that it will be cut-off quickly, and at the lowest possible tool cost.

MARVEL Hack Saws are fine machine tools, with all the built-in accuracy this description implies. Designed to operate at higher speeds, with the heaviest feed pressures, they have almost unlimited power and stamina to stand up to the most severe service.

MARVEL Hack Saws are truly multi-purpose cutting-off machines. *No* run is too short or too long, *no* material too mild or too tough to be accurately and efficiently cut-off on a MARVEL Hack Saw.

Catalog C56 has complete details, facts and figures on MARVEL Metal Cutting Saws. Write for it today.

S-1306

ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. • CHICAGO 39, ILLINOIS

MARVEL Metal Cutting SAWS
Better Machines–Better Blades

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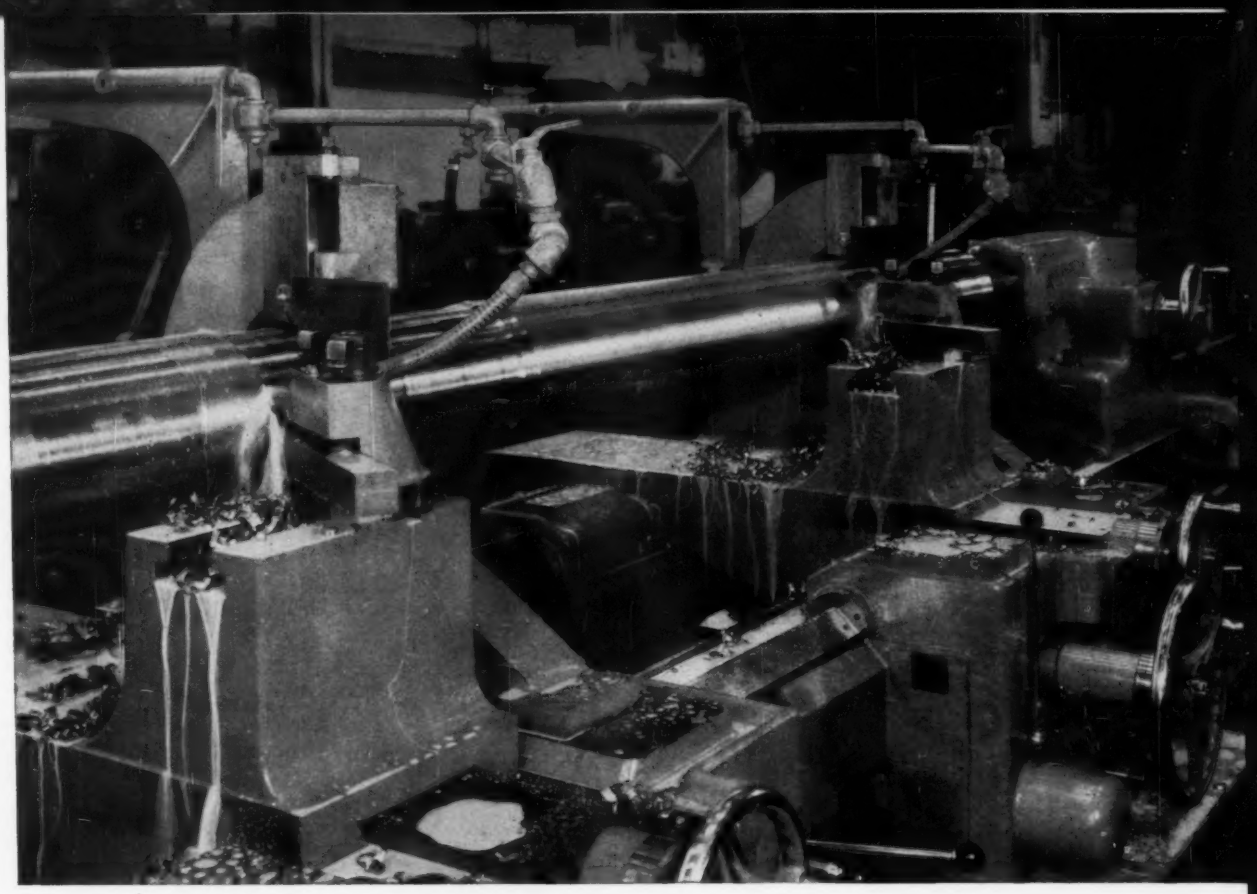
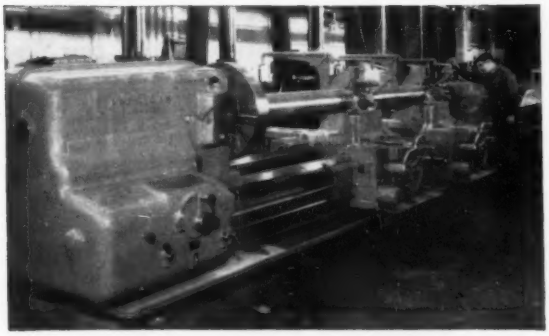


Cutting with two Carriages equipped with plain block rests and follow rests.

MACHINING TITANIUM BILLETS



32 inch "American" Double Carriage Pacemaker Lathe.

An extremely difficult job — a real challenge to the rigidity, stamina and "staying" qualities of any lathe.

Cutting titanium offers terrific resistance to the cutting tool which in turn demands maximum rigidity of the tool supporting members in order to hold vibration to the very minimum; otherwise chatter and high tool mortality are inevitable.

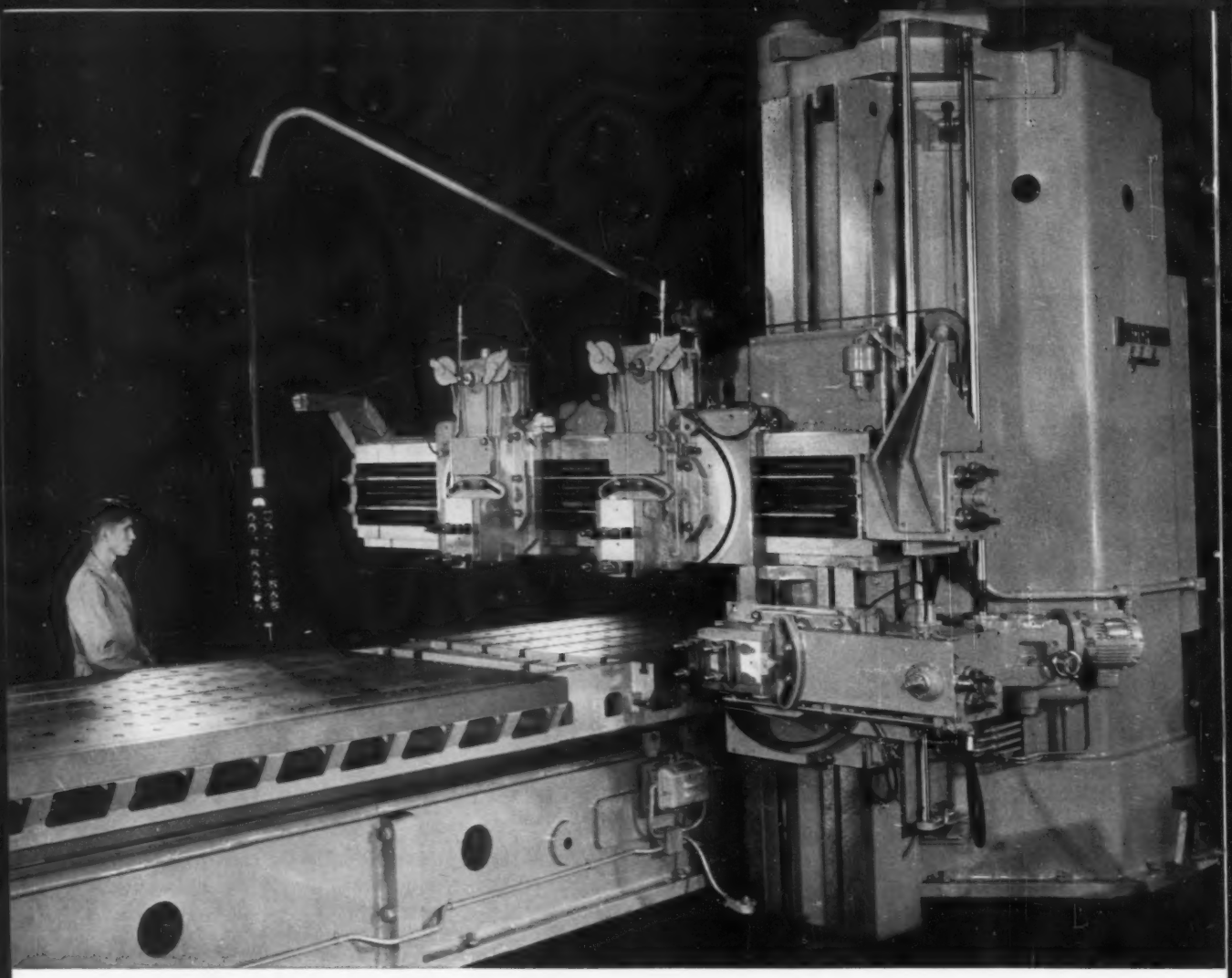
The fact that all of the major titanium fabricators are using "AMERICAN" Lathes, selected only after repeated demonstrations, is conclusive testimony to the power, stamina and rigidity of these machines.

There are exclusive features which definitely contribute to this result, such as the wide, four vee bed with walls rigidly tied together between the girths by an angular web which forms a chute for quick disposal of chips; replaceable hardened tool steel vees; solid 3-vee mounting of the carriage on the bed; powerful headstock with triple bearing spindle and bearing adjustment from the outside and others which space limitations prevent mentioning.

For a complete description of all of these features just send for bulletin No. 144.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS



HOW TO PROTECT A HYDRAULIC SYSTEM FROM RUST, SLUDGE AND FOAM

Hydraulic equipment and controls work more smoothly, production stays on schedule, when your hydraulic fluid is Texaco Regal Oil R&O. This great oil has far more oxidation resistance than ordinary turbine quality oil—is fortified with special Texaco additives that prevent rust, sludge and foam.

Throughout its extra long service life, Texaco Regal Oil R&O keeps hydraulic systems clean, minimizes wear, increases parts life and reduces maintenance costs.

There is a complete line of Texaco Regal Oils R&O to meet the requirements of all hydraulic equipment—from delicate controls to giant presses—and all operating conditions. A Texaco Lubrication Engineer will gladly help you select the proper one.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

- Out of This World
- Nine Out of Ten
- Other "Count-Downs"
- Back to Earth

Keeping up with Washington

Loring F. Overman

With officialdom somewhat less concerned with problems of recession, mid-summer Washington turned its thoughts once more to outer space. Possibly national planners are reaching the conclusion that the mathematically predictable behavior of space is simpler of solution than the whimsies of earthbound economies and ideologies. In any event, preparations for adventures "out of this world" were reasonably sure of a high priority.

Nine Out of Ten

The Office of Defense Mobilization recently issued ten certificates of necessity for accelerated amortization, for tax purposes, of new defense facilities. Nine of the ten were in the field of missiles; one, military aircraft components.

The certificates were the first issued since August, 1957, when the 1954 Internal Revenue Code was amended. The amendment limited certification to facilities for the production of new or specialized defense items or components, or to provide research, developmental, or experimental services for the Department of Defense or the Atomic Energy Commission, as part of the national defense program.

Some $25,000,000 in new facilities were involved. Although the amount of itself is not large—as Washington figures—machinery people will recognize it as indicating where to look for defense authorizations.

Other "Count-Downs"

Among the more dramatic projects on which machinery people may wish to focus, "tracking equipment" is the "dyna-soar." Considered an important step toward manned space flight, the program authorized by the Air Force directs two competing teams of flight-industry companies to develop a "dynamic soaring" aircraft for space flight.

The Glenn L. Martin Co. and the Boeing Airplane Co. will captain the two teams, with the National Advisory Committee for Aeronautics participating in development and observation. The Martin team will include Bell Aircraft Corporation; American Machine & Foundry Co.; Bendix Aviation Corporation; Goodyear Aircraft Corporation; and Minneapolis-Honeywell Regulator Co. On the Boeing team are: Aerojet-General Corporation; Chance-Vought Aircraft, Inc.; Missile Division, North American Aviation, Inc.; Ramo-Wooldridge Corporation; the General Electric Co.; and Autonetics Division, North American Aviation, Inc.

As explained by the Air Force, the manned vehicle "will have capabilities for many varying missions because it can operate from space altitudes down to well within the atmosphere, where it can maneuver and be recovered undamaged." From one to many orbits will be possible.

Another indicator of the increasing importance of out-of-this-world projectiles (and of the machinery for their production) is the fact that the Army has obligations of $426,000,000 on its books for the intermediate-range (IRBM) programs.

Convair Division of the General Dynamics Corporation has announced a revolutionary time-and-money-saving method of building wind-tunnel models by tape-controlled, automated machinery instead of by hand. Required to create the first wing model were a digital computer, a numerical control director, and a profiler capable of cutting materials in compound curves directed by instructions on a magnetic tape.

Permanence of the satellite program is indicated by recent action of the Advance Research Projects Agency. ARPA has acted to continue indefinitely the network of satellite-tracking stations placed in operation as part of the International Geophysical Year program which will end December 31, 1958. Action to continue the network was taken in conjunction with the National Advisory Committee for Aeronautics and the National Science Foundation. ARPA observed that one of the major purposes in pursuing the program "is to insure that 'silent' satellites will not be able to orbit over the United States without being detected and tracked."

The 1960 fiscal year budget for the Department of Defense will be somewhat higher than the $40,849,723,000 budget asked of Congress for fiscal year 1959, according to Defense Secretary McElroy. An increase up to $2,000,000,000 is anticipated by Washington observers.

Back to Earth

National Bureau of Standards has issued a 373-page supplementary list of publications covering the ten-year period, July 1, 1947, to June 30, 1957. Included in the list are circulars, handbooks, research papers, and miscellaneous publications. The catalogue gives brief digests. Designated as Supplement to the National Bureau of Standards Circular 460, the publication may be purchased at $1.50 per copy from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Commerce Department forecasters are not too optimistic over the outlook for new plant and equipment spending for the balance of this year, and on into 1959. The half-year forecast places 1958 spending at a $30,800,000,000 total—4 per cent less than previously estimated, and 17 per cent under last year.

Machinery people may be able to glean some comfort from the prediction by the Commerce Department that the worst of the drop is over. Through 1959, barring some unforeseen boom, Commerce sees plant and equipment spending off another 2 per cent per quarter (1958 drop has been 3 per cent per quarter). Such an estimate, if correct, would result in a total $27,000,000,000 plant-equipment expenditure for next year.

For more information fill in page number on Inquiry Card, on page 161

Machinery
AUGUST 1958

The Price of Eggs

A MOTION PICTURE recently produced by the Jones & Lamson Machine Co. starts off with a scene showing a motorist at a roadside counter where three identical cartons of eggs are on display. One sign reads "extra large, fresh, fancy hen's eggs." The farmer insists that there is no difference between the eggs contained in the several boxes even though the boxes are marked for sale at $1, 90 cents, and 75 cents, respectively. The customer is presumed to be a manufacturer who naturally considers the farmer an eccentric.

Days later, however, the manufacturer was up against a pricing situation in his own shop that forcefully recalled the egg episode. He found, in bidding on a potential order, that he could supply machined parts of the same quality at three different prices. An important contract was at stake.

The proposed order called for 20,000 parts a month for two years at a price of $1.02 per part. Cost analyses showed that by using two different types of machines already installed in the plant, the cost per part would be $1.32 on one type of machine, 15 years old, and $1.024 on other machines, 9 years old. However, by buying a new machine, the same part could be produced for 93 cents with further cost reductions attainable through automatic handling.

The motion picture then makes a complete analysis of the situation in an easily understood manner. It shows conclusively that in the case of the example under discussion, the new machine would make a profit of $54,818 per year more than if seven old machines were used. The calculations include the prorated cost of the new equipment. The old machines are considered as having been depreciated for their full original cost.

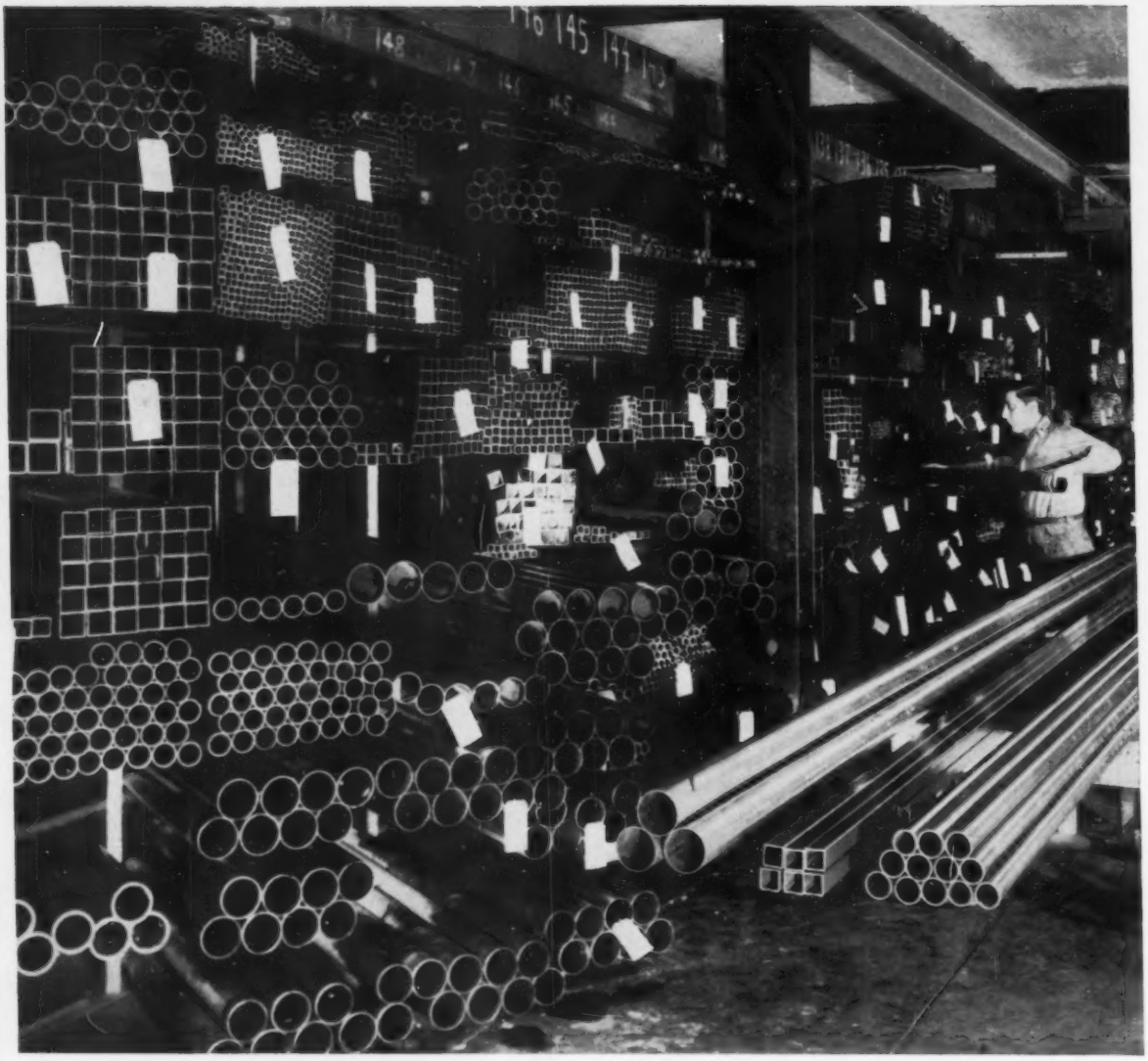
Similar analyses would be applicable to myriads of operations throughout the metalworking industry. Every manufacturer is faced with such problems sooner or later. He must either expand facilities to get increased production or retool to enable lower production costs so as to meet competition and hold business.

The major concern of any management is profit, and so the true cost of producing any work-piece is a matter of prime importance. Aged machines are generally money losers if there is work on hand to keep them busy.

The J & L movie should be a revelation to many plant managers. It can show them how to prove, unquestionably, to the financial men of the concern that modern equipment can pay big dividends.

Charles O. Herb

EDITOR



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"CHARACTER BUILDING"

is a precise job at Victor

H. M. WILSON, Vice-President
Victor Adding Machine Co., Chicago, Ill.

BUSINESS MACHINES manufactured by the Victor Adding Machine Co., Chicago, Ill., feature a printing-press action in which the paper is moved to meet the type, instead of having the type brought up to meet the paper. With this arrangement, which requires fewer machine parts, cylindrical type-sectors having rack-actuated gear segments are used instead of vertical-acting type-bars. A group of type-sectors on a Victor calculating machine are seen in the heading illustration.

Each type-sector consists of a blank (on the periphery of which the required characters are rolled), a stamped gear-sector, a hub, and two rack-retaining discs. The blanks are stamped from coils of a special, electric furnace grade of non-crystallizing, cold-rolled steel containing about 0.06 per cent carbon and 0.20 per cent manganese, hardened to 55 Rockwell B maximum.

The dimensions of a blank for one size type-sector are given at the left in Fig. 1. These blanks are stamped from 2 5/8-inch wide by 0.0375-inch thick coil stock on a 40-ton press operated at 120 strokes per minute. The three holes in each blank (used for driving by means of pins in the subsequent character-rolling operation) are pierced simultaneously in this same setup.

Blanks are drawn and pinch-trimmed to a cup shape (seen at the center in Fig. 1) on a 22-ton press operated at forty-five strokes per minute. It is essential that no score marks be formed on the periphery of the cup during drawing. After electrolytic cleaning the cups are swaged on a 95-ton press to the dimensions shown at the right.

Rolling of the characters on the peripheries of the swaged cups is done on a special, hydraulically operated machine, Fig. 2, designed by Victor engineers. Four consecutive sets of characters are embossed around each part, which is subsequently slit apart to provide four sections. The cup to be embossed is slipped on an arbor of the rolling machine and hydraulically clamped. One end of the split arbor is connected to an electric motor for rotating the work-piece, while the other end is provided with a hydraulic cylinder for clamping. Rotary thrust is taken up by three spring-loaded driving pins which enter the holes previously pierced in the cup.

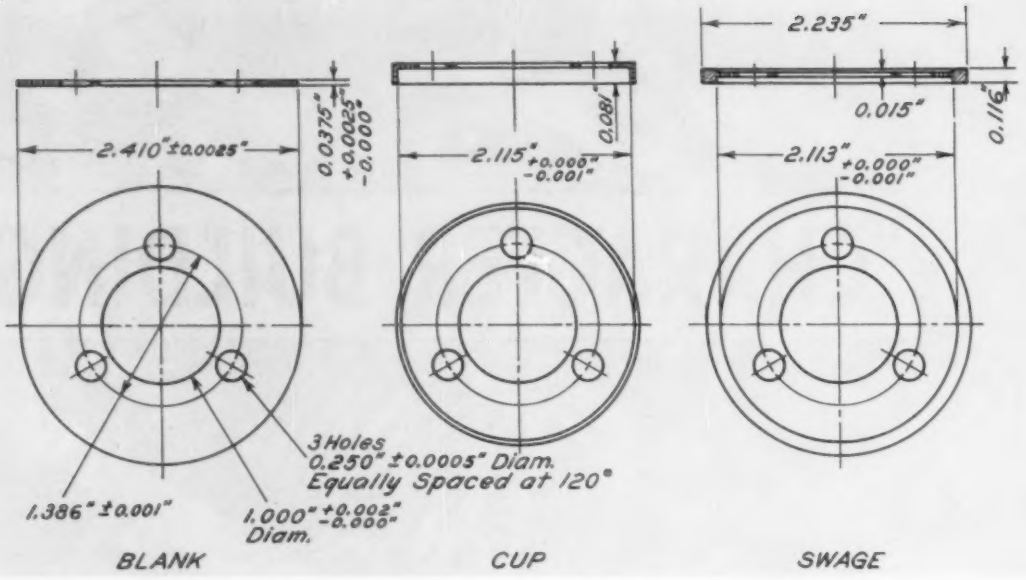

Fig. 1. (Above) Dimensions of blanked, cupped, and swaged parts for business machine type-sectors. The three holes are for driving purposes.

A master matrix roll (in the periphery of which the required characters have been sunk) is mounted on a shaft behind the arbor. The matrix is fed toward the work by a hydraulic cylinder seen at the upper right in Fig. 2. Rotation of the matrix roll is accomplished by means of a gear (mounted on the matrix-roll supporting shaft) that meshes with a gear on the motor-driven shaft. Extra-deep gear teeth are provided to permit continued infeed of the matrix roll after initial contact.

Three-dimensional master matrix rolls are made from a tough, close-grained tool steel, heated to a temperature of 1675 degrees F. and quenched in oil to attain a hardness of 62 to 63 Rockwell C. After drawing at a temperature of 325 degrees F. for two hours and again quenching in oil, the hardness is 60 to 61 Rockwell C.

Engraving of the forty characters around the periphery of each matrix is done on a Gorton two-dimensional pantograph machine, Fig. 3, equipped with a roll attachment to permit use of a flat master. A conical-point, single-flute cutter is used for this operation. Victor engineers design their own style characters, and prepare 50 to 1 or 100 to 1 enlargements on linen-base Masonite, glass, or brass templates for engraving the work.

While characters are being rolled on one part, the operator removes the driving holes from the cup previously embossed by piercing the center opening to a diameter of 1.700 inches. This operation is performed on a 20-ton press. Flash formed on the edges of the cups during rolling is removed by facing on a Hardinge lathe. Each part is placed on an arbor which is held in the lathe collet. Two single-point tools mounted on the hand-lever actuated cross-slide face both sides of the cup to a width of 0.110 inch.

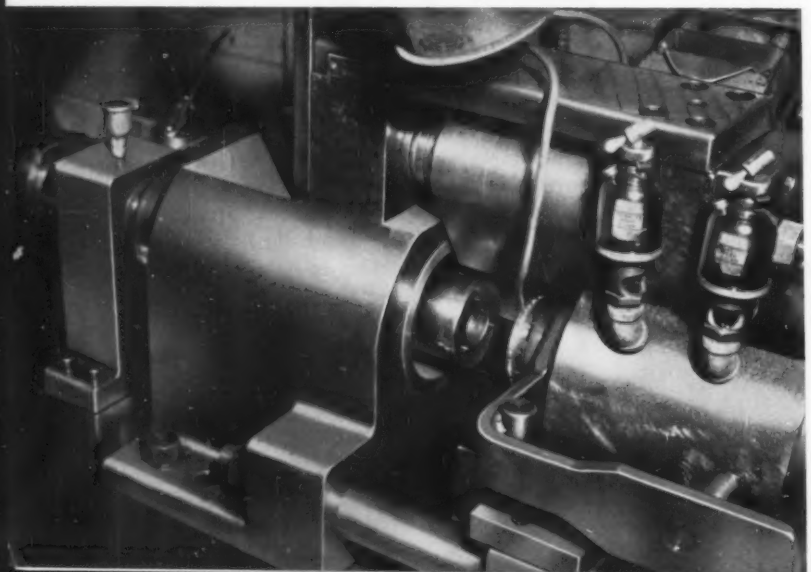

Fig. 2. (Left) Special hydraulic machine for rolling characters on peripheries of swaged cups (Fig. 1). A master matrix roll is mounted behind the work-piece.

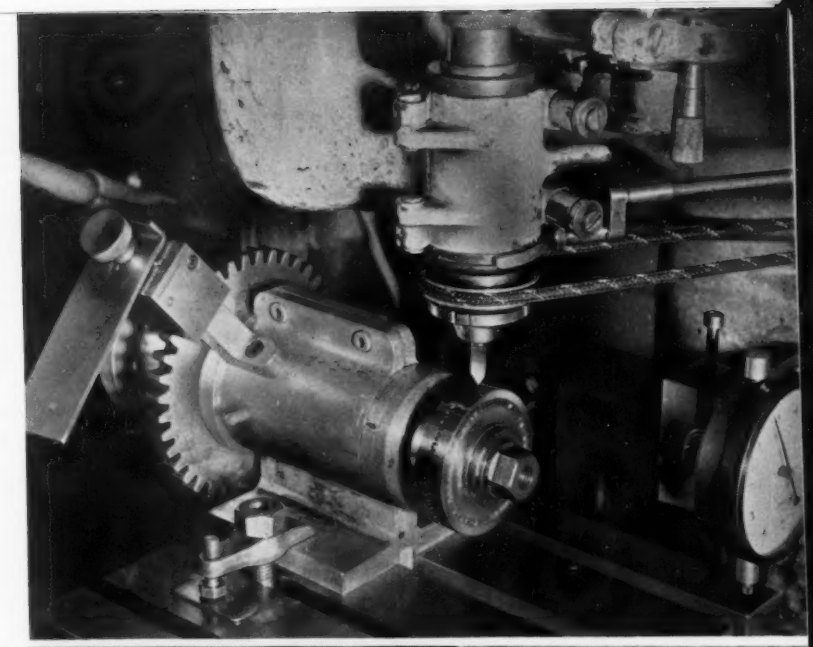

Fig. 3. Engraving of forty characters on the master matrix is done on a two-dimensional pantograph machine equipped with a roll attachment and flat template.

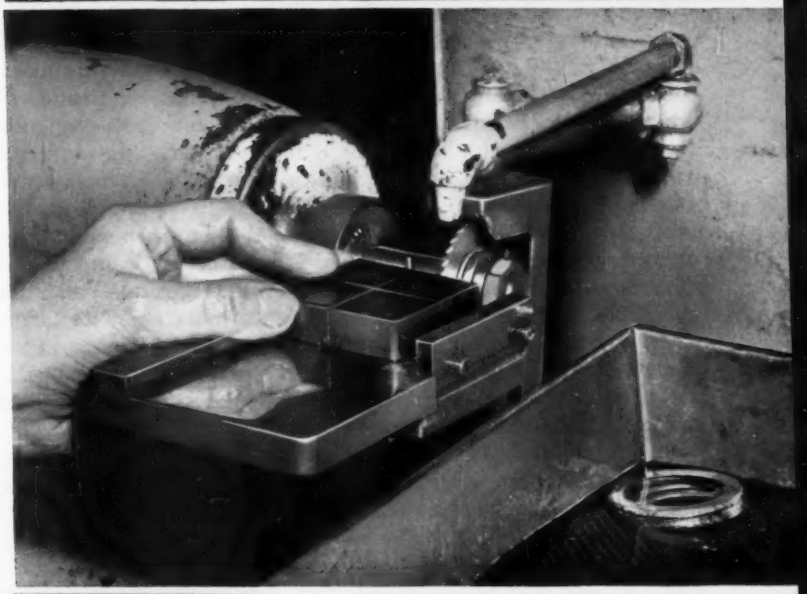

Fig. 4. Slitting saw held on arbor in lathe collet is employed to separate embossed cups into four equal sections. The work-holding fixture is manually indexed.

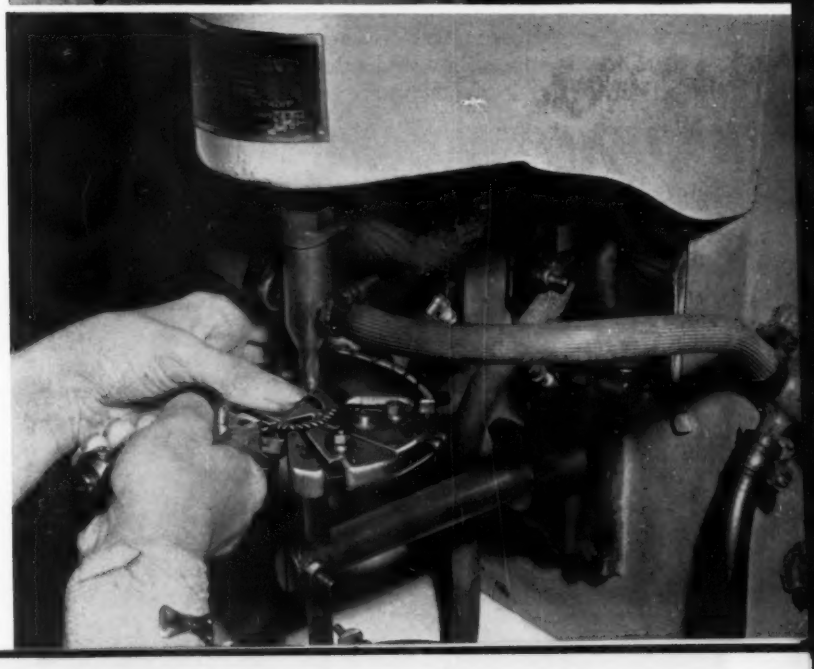

Fig. 5. Type-segment is joined to gear-sector by means of three spot-welds. Segment is located from raised characters by means of seven spring-loaded plungers.

Fig. 6. Controlled-atmosphere furnace employed to case-harden welded assemblies to a minimum depth of 0.003 inch and a hardness of 55 Rockwell C.

The trimmed cups are each divided into four equal sections by slitting on another Hardinge lathe, Fig. 4. A slitting saw is mounted on an arbor held in the lathe collet, and the work-piece is placed in a square block having a central arbor for locating purposes. The block fixture is slotted on each side to permit entry of the slitting saw. Indexing is performed manually. The fixture is located between two bearing slides on the lathe cross-slide, and the work is pushed into the saw.

Gear-sectors are stamped from coils of 0.035-inch thick, electrolytic-copper coated, cold-rolled steel. The copper coating permits selective hardening of only the edges of the gear teeth. Without the coating, distortion would result from hardening all surfaces of the sectors. An embossed cup section (type-segment) is spot-welded to each gear-sector on a Weldex 12-kva machine, Fig. 5. Welds are made at three spots.

An intricate welding fixture is used for this operation. The fixture has seven radially acting, spring-loaded plungers which locate the segment from the raised characters on its periphery, and a gear-tooth pointed, spring-loaded slide for locating the gear-sector from the center tooth space. A type-segment is inserted in the fixture first, and a gear-sector is placed on top of the segment. The locating plungers also push the type-segment against the gear-sector to seat the assembly. Clamping is accomplished by a hand-operated locking mechanism.

Welded assemblies are strung on rods and suspended from fixtures for heat-treating in an Ipsen controlled-atmosphere furnace, Fig. 6. The parts are heated at a temperature of 1475 degrees F. for twenty minutes and quenched in oil. This results in a case 0.003 to 0.005 inch deep with a minimum hardness of 55 Rockwell C. The hardened assemblies are cadmium-plated for corrosion resistance.

A bearing hub and two rack-retaining discs are then assembled to each type-sector. One disc is placed on each side of the sector, and one end of the hub is rolled over one of the discs on a Grant spinning machine, Fig. 7. Finally, the hub bore is reamed and deburred, and after final inspection, the type-sectors are ready for assembly in various Victor business machines.

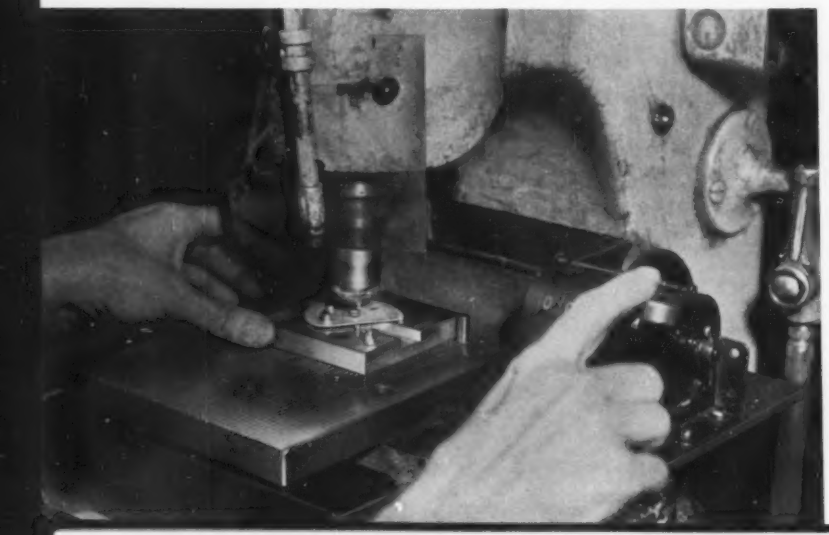

Fig. 7. End of bearing hub is rolled over face of one of two rack-retaining discs on this rotary spinning machine. Type-sectors are then ready for assembly.

How to Plan an Effective Suggestion System

ROBLEY D. STEVENS
Management Consultant
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THE ONLY THING CONSTANT in life is change. Employers engaged in the manufacture of metal products do not operate their businesses precisely as they did ten years ago, or even five. Changes most often come from within rather than from without. Employes' needs dictate new approaches. Competitors dictate others. Technological improvements bring about still more. But, since change is inevitable, it is wise for employers to anticipate it and prepare themselves and their businesses so that whatever occurs is for the better.

Progressive plant management is sensitive to the fact that changes can bring opportunity and is alert for significant ones affecting its operations. Because American industry is famous for its ingenuity, management will discover that the planning and use of an effective suggestion system are a means to draw on the skill of all employes. A properly operated system will give a plant a competitive advantage by improving its products, services, methods, and working conditions. Whatever reasons are advanced, it must be admitted that plants—large, medium, and small alike—will find a suggestion system a potent force for generating new ideas and improving management-labor relations.

If a suggestion system should be installed, the question would then arise as to how and to what extent should it function? The following proposals are designed to serve as guideposts for analyzing the potentials of such a system objectively, in the light of plant requirements. A suggestion system should be a dynamic, tailor-made function, fitted with great care to the needs of the particular plant. What works well for one plant may not work for another. Like any other management tool, a suggestion system can be overrated or misapplied, but its proper use can result in profits.

The basis for the gathering and fostering of employe ideas is simple enough. Each employe in a plant spends much of his work day performing one or many functions. He probably knows the details of his own job better than anyone else, including his supervisor or foreman, and sees it from many different points of view. Often he may, and in practice, does, have ideas about better ways to perform his work. The employe may also have many constructive proposals for increasing plant production, lowering costs, or improving employer-employe relationships.

Employes, however, may be reluctant to present new ideas, believing that the supervisor or foreman will think it a reflection on themselves for not having presented the idea first. Also, employes may feel that all the financial benefits from their ideas will accrue to management. If a plant has no recognized channel for making suggestions, employes do not offer any. By having a formal plan, plant management can, in most cases, overcome the foregoing factors and encourage all employes to submit new ideas when they have them.

Setting Up the Suggestion System

There are certain essentials for instituting an effective suggestion system. Someone in the plant must have the responsibility for it, and the supervisor or foreman should play a major role. Most plant employes report to him for work orders, materials, discipline, and for recognition of merit. Few workers come in contact with anyone above a supervisor. Therefore, to the employe, the supervisor is plant management.

Management should choose the supervisor carefully, primarily because he needs certain qualities for running the suggestion system. The individual selected for this task should be research-minded, have imagination, and be receptive to new ideas. He should also possess organizing and leadership ability, as well as sound judgment and character. He should be tactful, and capable of winning the confidence of employes. He must pledge complete protection of employe ideas entrusted to him and not seek any personal gain from such ideas, which, in fact, belong to plant management.

His major duties will entail the following: seeing that suggestion boxes and forms are located throughout the plant and that files are kept in

good condition; collecting of employe suggestions at frequent intervals; and checking to see that each suggestion is understandable and clear. He will keep all correspondence and records in connection with the suggestion system confidential; present each suggestion to plant management for appropriate action; and notify the suggester of the decision on his idea.

Rewards Based on Savings

Rewards never fail to motivate interest, if they are the right ones. Any compensation should have a direct relationship to the suggestion. Experience reveals that the more generous the rewards, the more effective the suggestion system and the greater the eventual savings. Cash payment always seems best. A minimum amount should be established, but there should be no maximum. It is good psychology to let the sky be the limit.

In some plants the suggester is given as little as $50; in others, rewards as high as $2500 or more have been presented. All rewards, however, should be based on the estimated net savings from use of the employe idea. In deciding upon the amounts to be paid, remember that rewards are not a matter of generosity, but of stimulating plant employes to think constructively about their jobs. This can be a powerful device to improve methods and promote greater employe efficiency. Unless the suggestion actually results in savings, no reward should be given. If plant management approves a suggestion system, all employes, except supervisory personnel, should be eligible to participate. The help should be at liberty to make suggestions and consult freely with supervisory personnel about their ideas. It is, of course, necessary to keep plant employes aware of the suggestion system in order to generate interest.

The incentives for launching a suggestion system in a plant can be many and well-justified, but there may be legal considerations involved. For instance, an employe suggestion may involve a patentable idea. Plant-management policies about such ideas vary widely. Your attorney should look into the various aspects. Is the idea patentable? If a formula is involved, is it properly protected? Will legal steps be necessary to protect the idea? Is the idea to be used in the plant, or outside?

In any event, plant management may require the employe to sign an agreement, stating that the company will get all rights to the idea or invention developed by him after a substantial reward has been given from the sale or licensing of the patent, so that the employe will not feel he has been misled.

Plant management cannot increase production or lower operating costs with employe ideas that stay in the file. They should be evaluated carefully for possibilities of use. For obvious reasons, "gripes" in the form of suggestions should be disregarded. Remember, however, that ideas that may seem trivial to the supervisor or foreman may be a sincere expression on the part of the suggester who is trying for a reward. Most workers will be just as interested in seeing their ideas applied as they will in receiving an award. It should be a plant policy to specifically state that employes' suggestions are not a reflection upon supervisory personnel as a part of plant management.

Whether adopted in a large, medium, or small plant, it should be remembered that a suggestion system is a business venture, not an employe-benefit plan, because it can provide good returns. Suggestions received from plant employes will probably have to be modified by management before adoption, but each idea should be carefully evaluated.

Before installing an effective suggestion system, plant management will find it desirable to test it for several months in order to determine the most efficient way it can be utilized for profitable results. The accompanying form is typical of those used in employe suggestion systems.

EMPLOYE SUGGESTION FORM

Name .....

Position .....

Department .....

Wage-Rate .....

Supervisor .....

1. *The Problem:* Describe situation which promoted this suggestion.

2. *The Suggestion:* Describe the proposal—how it can be used and what it will actually accomplish in saving money, time, material, and manpower; and in improving service, safety, morale, and working conditions.

3. *What department will this suggestion affect?*

4. *Other comments:*

I hereby agree that the use of my suggestion by this plant management shall not form the basis for a claim of any nature upon my employer by me, my heirs, or assigns. I agree to accept any award given for the adoption of my idea.

Signature .....

Balancing the Output of a Segmented Production Line

TRUE BALANCING of a segmented production line for cylinder blocks has been accomplished at the Buick Motor Division of General Motors Corporation, Flint, Mich., with a conveyorized pallet system made by the F. Jos. Lamb Co., Detroit, Mich. This system, partially seen in the heading illustration and in Fig. 1, is employed to transfer blocks from four faster-cycling milling machines to eight slower-cycling boring machines, or to a storage conveyor used for banking the blocks.

Individual machines were provided for these operations, instead of a single transfer type machine, in order to attain maximum production efficiency and flexibility. Also, this segmented arrangement facilitates banking of the blocks be-

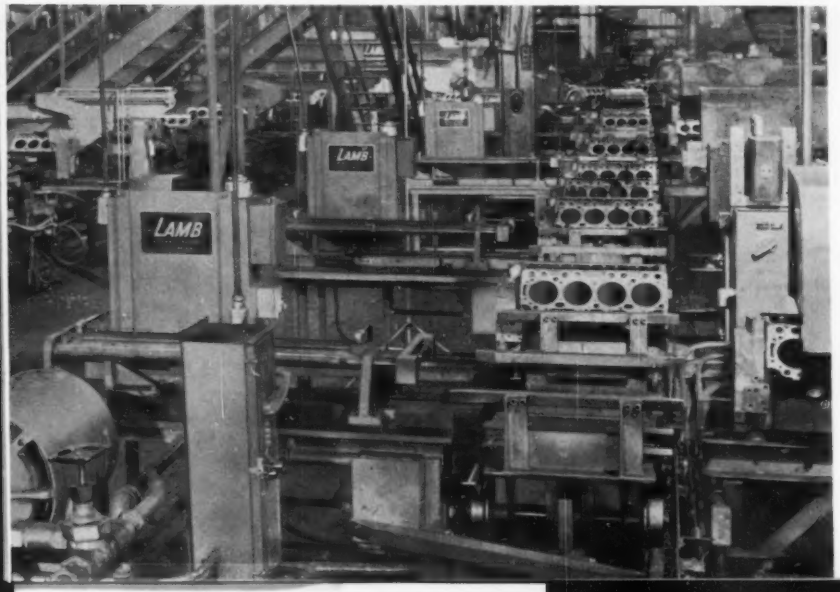


Fig. 1. Automotive-engine cylinder blocks, mounted on individual pallets, are transferred along closed-loop track at the rate of 28 feet per minute by means of a chain-driven conveyor.

tween operations, and can easily be adapted to possible future requirements for increased production or changes in the product. Another advantage is that partial production can still be maintained if one or any combination of several of the machines have to be shut down for tool changes or repairs.

The oval-shaped, closed-loop conveyor is chain-driven at the rate of 28 feet per minute, and equipped with ninety-five drive-dogs (one spaced every 2 feet) for transferring the pallets. Each pallet, weighing 310 pounds, is mounted on four wheels, which roll along tracks. The pallets hold the blocks above the transfer conveyor to avoid damaging the bearing caps which extend below the pan-rail surfaces of the skirt type cylinder blocks.

On the four Sundstrand milling machines, indicated across the top in Fig. 2, the flywheel-housing ends of the blocks are milled. These machines unload each block into position *A* on one of the four hydraulically operated turntables, which rotate the parts 90 degrees in a horizontal plane into the required position for loading in the next machining operation. Simultaneously, an empty pallet is disengaged, located, and locked in an aligned position with the turntable, as seen in Fig. 3.

Lamb hydraulically actuated loading devices are provided to transfer the blocks from any turntable to an empty pallet—from position *A* to *B* in Fig. 2. During this loading time, the remainder of the system continues to operate without interruption. Then, the loaded pallet is automatically unlocked, reset, picked up by the conveyor, and transferred to the right and clockwise along the conveyor. Pallets carrying oversize blocks are manually stopped at position *C*, and the blocks are pushed off the pallets onto a roller conveyor leading to two Ex-Cell-O hand-operated machines where the cylinders are bored.

Another block (from a storage roller conveyor in the center of the distribution installation) is loaded into the empty pallet while it is stopped in this position. After again being transferred in a clockwise direction along the conveyor, the loaded pallets are automatically stopped on demand at any one of the six positions *D*. Here, Lamb hydraulic unloading units push the blocks from the pallets onto the pre-load stations *E*. This

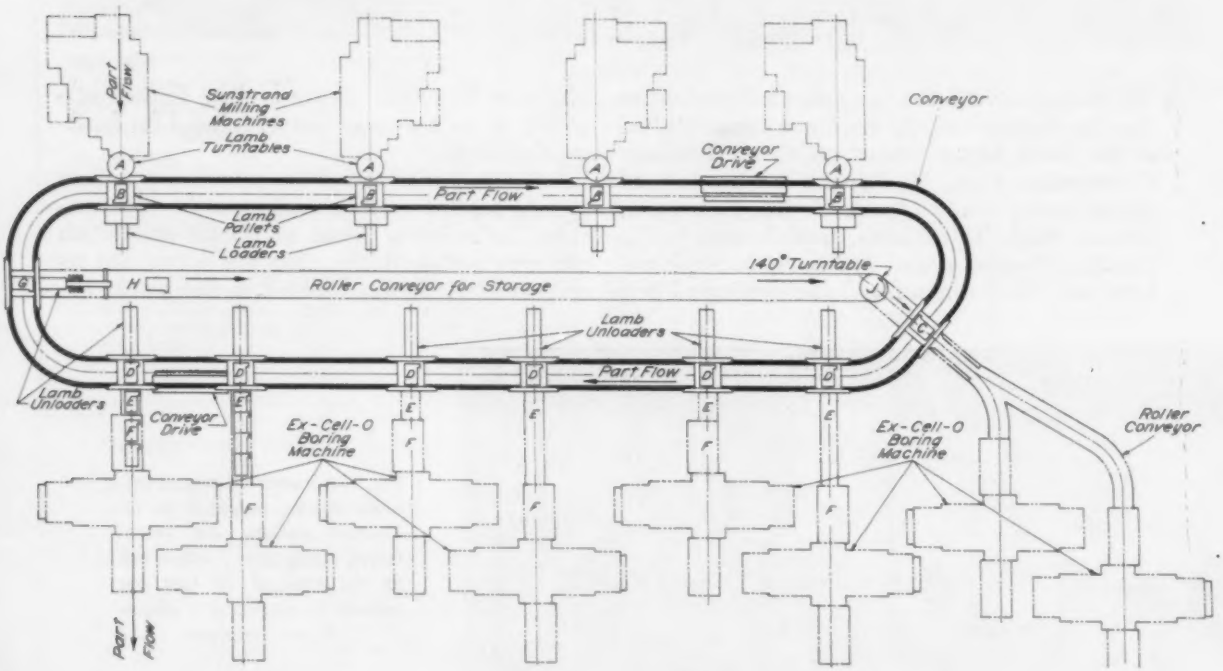


Fig. 2. Schematic layout of a conveyorized pallet system for transferring cylinder blocks from the four milling machines seen at the top to eight boring machines shown along the bottom.

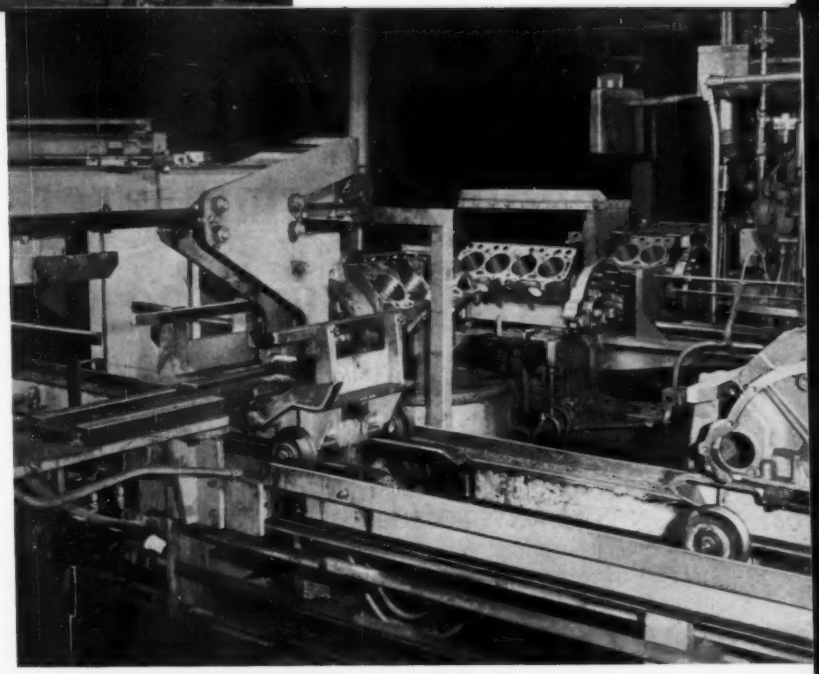


Fig. 3. (Right) Blocks unloaded from milling machine (right rear) are rotated 90 degrees on a hydraulic turntable and pulled onto empty pallets on conveyor (foreground).

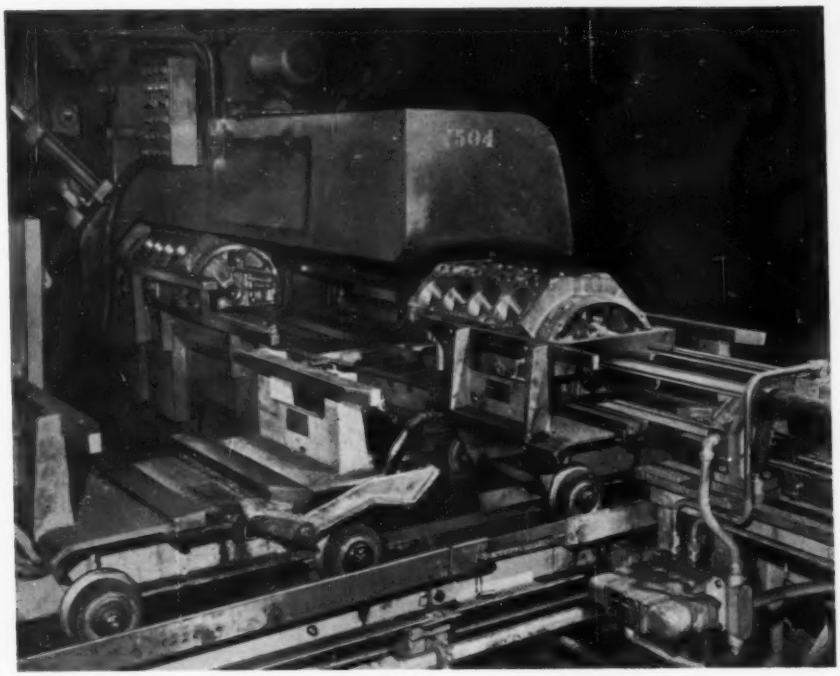


Fig. 4. (Left) Hydraulically operated unloading unit pushes cylinder blocks from the pallets onto a roller conveyor, from which they are loaded, two at a time, into a cylinder-boring machine.

automatic unloading operation can be seen clearly in Fig. 4.

Cylinder blocks are automatically picked up, two at a time, at position *F* (Fig. 2) and loaded into one of the six Ex-Cell-O automatic, cylinder-boring machines. Any pallet that is still carrying a block is either recirculated or automatically unloaded when it reaches position *G*. Here, the pallet is stopped, and the block is pushed onto roller conveyor *H* for storage. At position *J* on this conveyor, a turntable is provided to rotate the blocks through an angle of 140 degrees for reloading into empty pallets at position *C* when required. The pallets emptied at positions *D* or *G* are conveyed back to the milling machines for reloading.

After the blocks have been unloaded from the Ex-Cell-O machines, their cylinder bores are rough- and finish-honed in two separate operations. Then the blocks are washed, leak-tested, and inspected for selective assembly with matching pistons. After adding other parts and performing a complete final inspection and test, the engines are ready to be assembled in the cars.

Bending Normal Press Movement "Round-the-Corner"

FEDERICO STRASSER
Santiago, Chile

IT IS NOT ALWAYS POSSIBLE to effect all desired work-forming actions directly from the normal movement of a press ram. This vertical movement—or, more correctly, movement that is perpendicular to the press table—must, in many instances, be redirected into a relatively horizontal plane. Although this occurs most often in second-operation tools, it does arise occasionally in progressive type dies.

Some of the more common applications for which a horizontal press movement would be well-suited include lateral punching, trimming, notching, forming, bending, shallow drawing, indexing, and actuation of feed magazines. In addition, some tools incorporate a means of lateral clamping during the time an operation is taking place, followed by a positive release. Tools such as these are more expensive than dies of conventional design: albeit, they are frequently used by reason of their several advantages.

There is more than one method of converting the natural direction of press-ram movement to a direction necessary for the job at hand. The most-used techniques employ one, or more, of the following design features:

1. Single-acting cams (including inclined planes, wedges, tapers, and horizontal cams) for the active phase of press operation, with springs or other members bringing about the return movement of the punch.
2. Double-acting cams (including inclined bars and angular slots), providing positive return.
3. Single links, or levers.
4. Double links, or toggles.
5. Rotating tool members.
6. Pivoting jaws.
7. Racks and pinions.

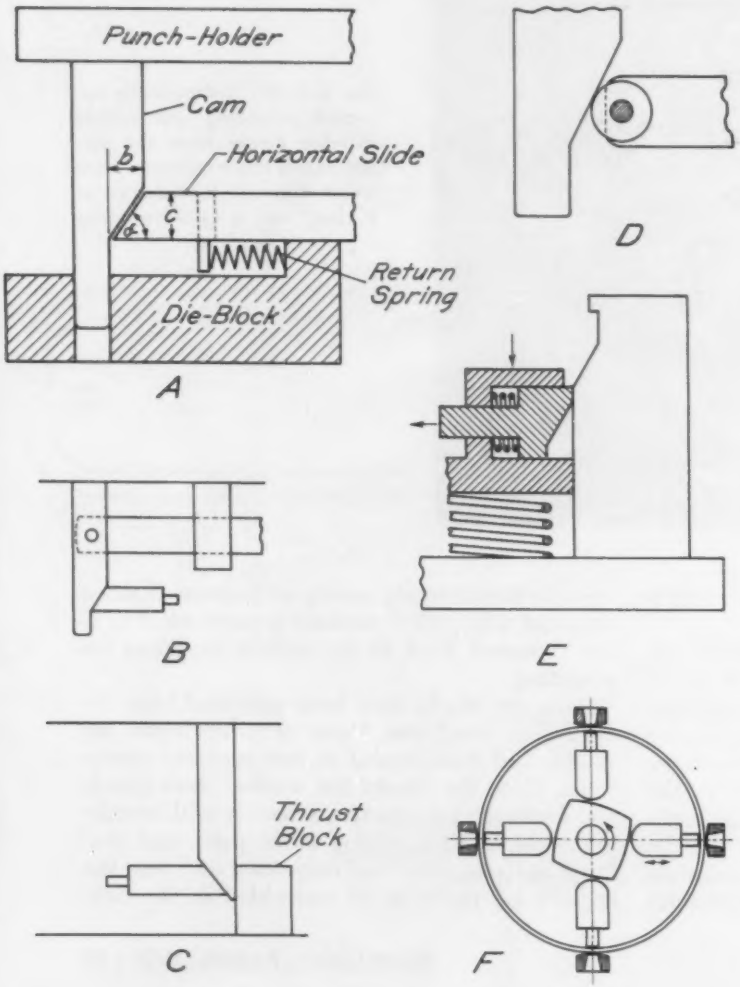


Fig. 1. Shown are various types of single-acting cams designed to impart horizontal slide movement in a press tool. A spring is usually required with these cams to effect return of the slide.

Single-Acting Cams

In Fig. 1 are shown the operating principles of several types of single-acting cams. The cam is usually a heavy bar (either rectangular or circular) carried by the punch-holder, thus deriving its vertical movement from the press ram. A matching cam surface on the horizontal slide receives the thrust from this member. At the upward stroke of the press ram, the slide is returned to its original position by spring action.

Although wedge angle α, View A, may range from 20 to 60 degrees, it cannot be selected arbitrarily. It depends chiefly on the required stroke of the horizontal slide and the vertical movement of the ram. The angle can be found by simple trigonometric solution:

$$\text{Tan } \alpha = \frac{c}{b}$$

Should neither the slide stroke nor the ram stroke need special consideration, then a common angle such as 30, 45, or 60 degrees can be used.

In dies designed to work under comparatively high pressures, some means should be used to avoid making the cam excessively large. This can be done in several ways. A tongue on the lower end of the cam member shown at A rides in an opening in the die-block, thereby providing the necessary additional support. If this is not practical, a connecting beam may be used as shown in View B, or a thrust block may be used to back up the cam as at C. Substitution of a roller, View D, for the slide-cam will reduce the operating friction considerably. By machining multiple tapers on the cam member, more than one slide can be actuated.

Not all cams are attached to the punch-holder—they are sometimes a part of the die-block. Illustrated in View E is a design in which the cam member is supported by the die-block and the horizontal slide is driven downward by the punch-holder. The slide is spring-loaded horizontally and the slide housing is spring-loaded vertically.

With heavy-duty tooling, where friction and wear are of moment, it is advisable to surface one of the inclined planes with a hardened tool-steel plate, and the other inclined plane with a bronze plate. These sliding contact surfaces should be adequately lubricated.

Another type of single-acting cam arrangement is the horizontal cam shown in View F. Although a single cam operates four punch-slides simultaneously, springs are used to return the slides toward the center as the cam lobes pass by. The cam is mounted on a vertical shaft that receives its motion indirectly from the press.

Double-Acting Cams

The necessary use of springs with single-acting cams to retract the slides after stamping has been brought out in the preceding paragraphs. There are some disadvantages associated with the use of springs: space must be provided to contain them, press capacity must be greater to over-

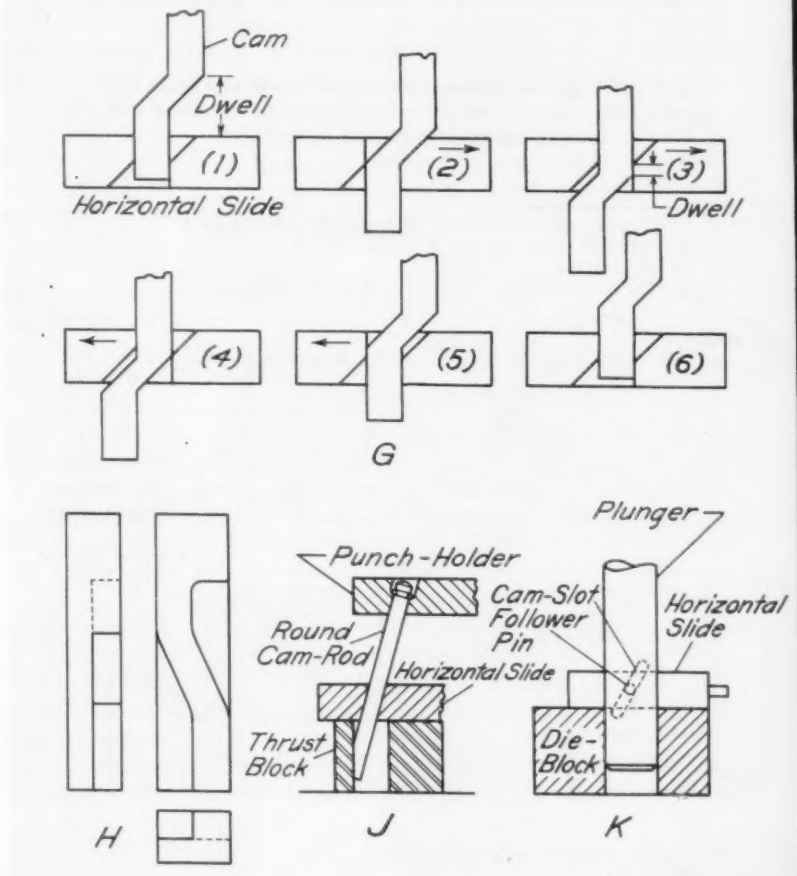


Fig. 2. No external devices are needed to effect return of the horizontal slide when using double-acting cams. Operating sequence of a standard double-acting cam is shown at (G).

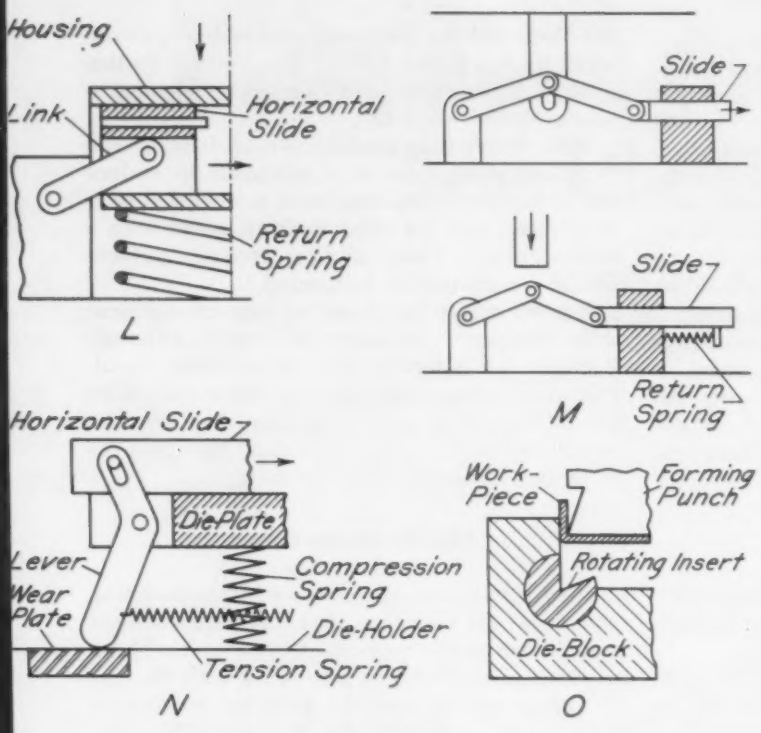
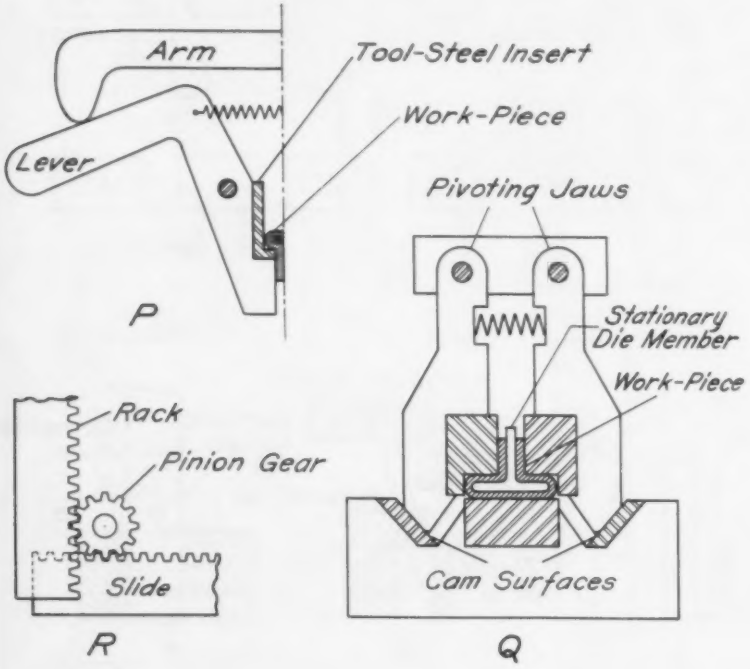


Fig. 3. Other methods of obtaining horizontal forming action from vertical ram travel include the illustrated mechanisms: double link (M), rotating lever (N), and rotating insert (O).

Fig. 4. Although their movements are not in a straight line, the pivoting die members at (P) and (Q) perform the same end function as would a true horizontal slide.



come spring forces, and spring failure during press operation may yield disastrous results. It is preferable, therefore, to design the tool with double-acting cams whenever possible.

A sequence diagram showing the movements of a standard double-acting cam during a normal down stroke and return stroke of a press ram can be seen at G in Fig. 2. When the cam moves down, the slide is forced to the right. During elevation of the cam, the slide undergoes a positive return movement to the left.

Double-acting cams can be reinforced by the same general methods described for single-acting cams. An especially efficient design of a reinforced cam capable of transmitting high pressures is shown in View H. Here, the cam shape is milled in one face of a solid steel block.

A different type of double-acting cam is illustrated in View J. It is an inexpensive design utilizing a length of round bar stock that is attached to the punch-holder at an angle. The rod passes through a matching inclined hole in the horizontal slide, thus displacing the slide as it is raised or lowered. It should be noted that at no time during normal operation of the tool does the rod become disengaged from the slide.

Although this cam design is not costly, it does have one notable drawback. The slightest movement of the press ram causes a corresponding horizontal displacement of the slide. This can be attributed to the absence of dwell points along the path traveled by the cam-rod. To compensate for this, the press must be in good condition (no vertical play of the ram) and the stroke must be accurately adjusted.

Another possible disadvantage of the inclined rod is that, in many applications, only limited pressure can be trans-

mitted. On the other hand, long horizontal travel may be accommodated. Because of this, inclined rods are usually preferred for forming, rather than cutting.

In cases where the working pressure is comparatively low—such as in the forming of thin stock—an inexpensive cam design can be used. It consists, basically, of a pin riding in an angular milled slot, View K. A round plunger is attached to the punch-holder and is supported at its lower end by the die-block. A blind cam-slot is milled in the plunger to receive a pin attached to the horizontal slide as shown.

Single- and Double-Link Movements

Single-link, or lever, mechanisms for obtaining a horizontal slide movement have several advantages to offer. One is that the tool is a self-contained unit. Such construction does not require perfect alignment between the moving and stationary parts of the tool. A second advantage is that large ram strokes may be used, simplifying loading and unloading of the work-pieces.

One form of simple lever mechanism is illustrated in View L, Fig. 3. The horizontal slide is contained within a housing that is free to move vertically. A link connects the slide with a stationary part of the die-block as shown. When the housing is pushed downward by a plunger (not shown), the link pivots around its fixed point and forces the slide to the right. As the plunger rises, the housing is returned to its original position by a compression spring.

Great pressure can be exerted by using a double-link (toggle principle) mechanism to actuate a horizontal tool-slide. This is because the links assume a position that is almost straight at the end of the stroke. Return of the tool-slide may be either positive (top, View M) or by means of a spring (bottom, View M).

Horizontal work-forming can also be accomplished through the action of rotating tool members. In View N is shown a design in which movement of the horizontal slide is controlled by a rotating lever. At the descent of the press ram, the entire die-plate is pushed downward against the die-holder. The lever is then forced to rotate in a clockwise direction, driving the slide to the right. Return of the lever and the die-plate is achieved by a tension spring and compression springs, respectively.

Should only a slight forming operation be required, the horizontal slide can be eliminated. Necessary movement can be obtained by a rotating member inserted in the die-block as shown in View O. The downward-moving punch contacts the inclined face of the forming insert, causing it to rotate. This action forces the vertical face of the insert to the right, sandwiching the upright wall of the work-piece between the insert and the forming punch. On the up stroke of the punch, the insert rotates to its original position under the influence of a counterweight extending radially from the rear of the member.

Pivoting Jaws, Racks, and Pinions

There are several basic designs in which the transformation of vertical press-ram movement into horizontal work-forming movement is effected through the medium of pivoting tool members. Actual movement of these members is not in a true horizontal plane; however, they produce the same end result as horizontally moving tool members.

A simple design is shown in View P, Fig. 4. Here, a double-arm actuates two pivoting levers (tool is symmetrical about center line), each lever carrying a shaped tool-steel insert. These inserts shape the preformed work-piece against a suitably machined die member.

For heavy-duty applications, the more elaborate design illustrated in View Q can be employed. A preformed (U-shaped) work-piece is placed around the stationary die member. Corresponding die surfaces are mounted toward the bottom of two pivoting jaws as shown. As the punch-holder descends, the cam surfaces on the lower ends of the jaws contact matching cam surfaces in V-grooves machined in the die-block. The jaws are forced inward to complete the forming operation.

In some instances a simple rack and pinion is used to impart horizontal movement, View R. Desired movement ratio between the rack and the slide can be obtained by using two gears of different sizes on the same axis—one meshing with the rack and the other with the slide.

* * *

Turning Steel at Speeds Up to 18,000 Surface Feet Per Minute

Ultra-high velocity machining of 1045 steel was recently demonstrated in the machinability laboratory of the General Electric Co.'s Metallurgical Products Department, Detroit, Mich. Cutting speeds up to 18,000 surface feet per minute were attained with a Grade 0-30 cemented-oxide tool on a specially designed 20-inch lathe. In this test, less than a minute was required for a single pass while turning a 13-inch diameter by 48-inch long bar with a 0.010 inch per revolution feed, and the depth of cut set at 0.100 inch. The high-velocity cutting was part of a series of new procedures developed to illustrate the possibilities of cemented-oxide tooling.

Self-Dumping Hoppers Enable Fast Scrap Handling

Fig. 1. Transferring the metal chips from a turret lathe into a caster-mounted hopper that can be dumped automatically into railway cars.

Fig. 2. Hopper elevated by a lift-truck automatically dumps its load of metal chips into a gondola car.

In many medium-size plants the disposal of metal chips and scrap from machine tools and presses constitutes a troublesome problem. Management frequently finds out that money is being lost when the time and cost of scrap disposal is compared with the prices received for scrap..

When the Goss Printing Press Co., Chicago, Ill., built its new plant, the adoption of self-dumping hoppers for handling scrap turned an inefficient salvage operation into a fast and economical procedure. In the Goss plant a considerable quantity of metal chips come from turret lathes, planers, and milling machines. In the old plant, the chips were loaded in oil barrels mounted on skids and hauled to a truck dock. This loading dock was generally tied up with barrels of scrap.

In the new plant, forty-one Roura hoppers of the type seen in Fig. 1 are placed at strategic points throughout the plant. Hoppers of two sizes are used with 3/4- and 1-cubic-yard capacities, respectively. Since the hoppers are mounted on casters they can be easily pushed from one location to another. Also, they are constructed for convenient handling by means of any standard fork truck.

Scrap-laden hoppers are pushed from machines to an aisle where they are picked up by a fork truck and hauled to a gondola railroad car. Without leaving his truck, the operator raises a handle on the hopper, thus causing it to automatically dump its load into the car, as illustrated in Fig. 2. No loading dock is necessary. Chips from 500 machine tools fill a gondola car in five days.

° ° °

Surplus Machine Tools for Schools

To help train the youth of the nation in industrial skills, a large number of machine tools and related equipment which are currently becoming excess to government requirements will be made available to state and local educational institutions through the Business and Defense Services Administration of the United States Department of Commerce. Actual distribution will be handled by state agencies for surplus property in each state, which work with the United States Department of Health, Education, and Welfare. Junior high schools, high schools, technical schools, colleges, and universities will be the beneficiaries of the program.

Lock Machining Keyed to High Output

F. J. GIANNITTI, Tool Engineer
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Yale & Towne Mfg. Co.,
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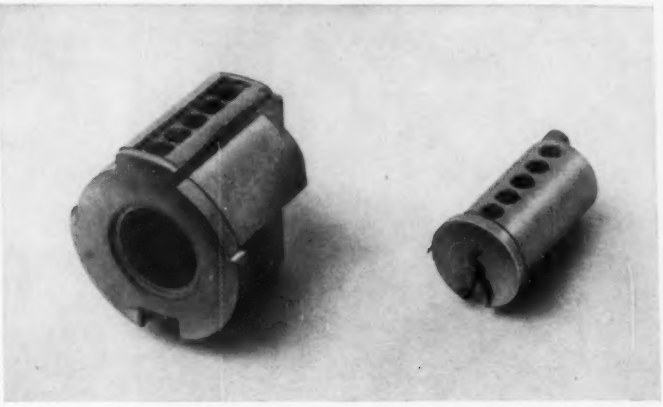


EFFICIENT PRODUCTION of small parts—largely die-castings of zinc alloy—is the chief concern at the plant of the Yale Lock & Hardware Division of the Yale & Towne Mfg. Co., Salem, Va. The die-castings are produced within the plant, often using multiple-cavity dies, and a considerable number of the parts have such irregular shapes that they are difficult to make in any other way. Although cast sizes are commonly held within close dimensional limits, all parts require flash removal and many need some additional machining.

Equipment for such machining is simple, but the operations often are expedited by unusual tooling. The larger of the cylinder-lock parts shown in Fig. 1 is die-cast, with the main parting plane at the flanged end. Flash around this end is sheared off in a trim die in the usual way. The five small, closely spaced cross-holes are for tumblers and are cored with transversely pulled cores. In addition to having cores for the five tumbler holes, the core slide is shaped to form the oblong recess in which the holes are located, and a ridge around this recess. Flash is produced at the intersections of the tumbler holes with the cylinder bore and around the oblong ridge.

A special air-operated tool is used to remove flash at these points as well as to true the five

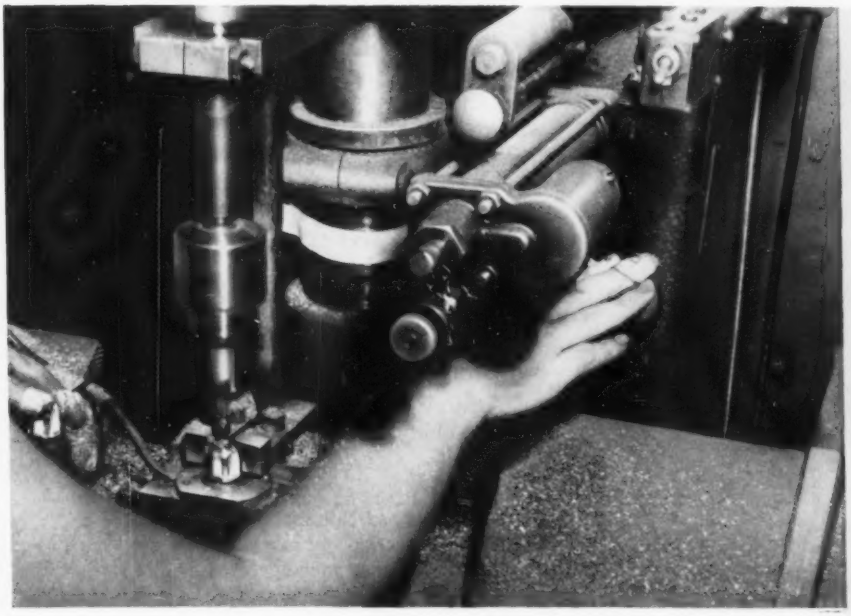


Fig. 1. (Above) Lock cylinder (left) is die-cast in zinc alloy with bore and side holes cored. Brass plug that fits the cylinder (right) has a broached key slot.

Fig. 2. (Left) Here, the bore in the die-cast cylinder, shown in close-up in Fig. 1, is reamed and one end is spot-faced to obtain a close-tolerance axial dimension.

Fig. 3. Five blind tumbler holes cored in these die-cast deck lock plugs are drilled through in rapid succession while the piece is clamped in a sliding V-block under a spring-loaded jig plate.

tumbler holes. The tool has five broaches that make shaving cuts in the holes, and two straight cutting edges that shear flash along the two longer sides of the oblong projection. This operation is accomplished with the casting supported in a recess that positions the hand-loaded work-piece accurately in relation to the tool. Broaching is done at the rate of 1350 pieces an hour.

After broaching, the lock cylinders are dropped onto a belt conveyor that advances them to a light Delta drill press (Fig. 2) arranged for air advance of a cutting tool by a Bellows feed. This rotary tool makes two cuts. First, it reams the cylinder bore, removing the draft left by the core-pin and any burrs that have been thrown into the bore by the broaching of the five side holes. In the second cut, a small amount of metal is machined from the stepped end by a spot-facing cutter that is above the reamer and surrounding its shank.

The distance from the face of the stepped recess at the lower end of the bore to that of the spot-faced surface is held between 0.803 and 0.805 inch. For this operation, the casting is located endwise by a boss on the fixture that supports the work-piece on the face of the stepped recess. A slide on this fixture acts as a stripper when the reamer is retracted. The stripper is advanced by a tapered bar located in back of the tool and is fed down with the latter. When the next piece is loaded, the stripper is moved back. This operation, which completes the machining of the casting, is accomplished at approximately the same piece rate as the broaching.

In another die-casting, called a "deck lock plug," there are five blind, cored tumbler holes that are drilled through one at a time in a light Delta drill press (Fig. 3). This work-piece is placed in a sliding V-block under a spring-loaded jig plate that slides on vertical guide pins. The jig plate is raised by hand as the piece is loaded. In this jig, which also locates the piece endwise, there are five holes spaced to align with those in the casting.

The jig plate, after being lowered to clamp the work-piece in the V-block, moves with the V-block as it is slid along, guided by the left hand

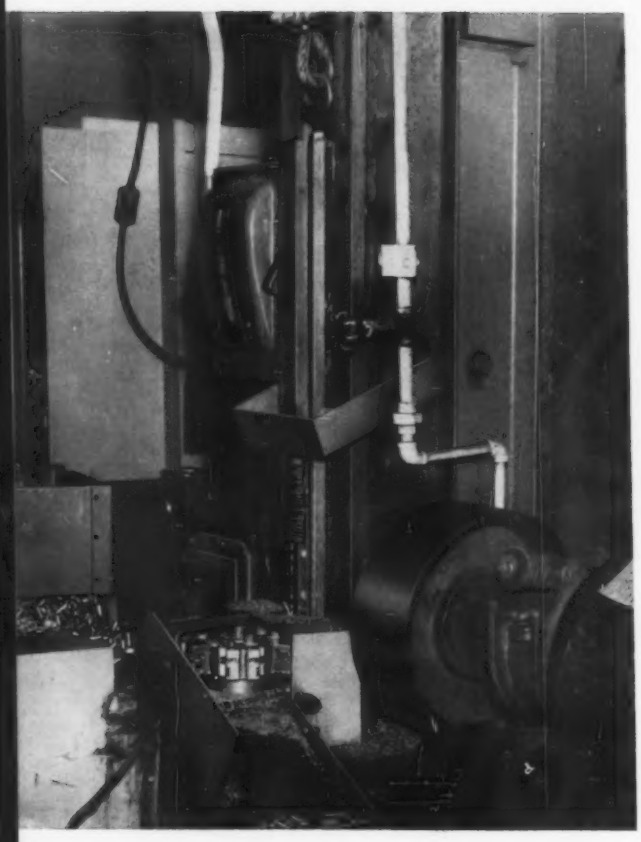


Fig. 4. Special automatic broaching machine that cuts key slots of wavy cross-section in brass plugs for cylinder locks. A counterbalanced rack operated by a reversing pinion holds the broach.

Fig. 5. Close-up view of the indexing fixture on the bed of the slot-broaching machine. Lock plugs are hand-loaded but are clamped and released automatically. Parts fall into a tote-box.

of the operator. With the other hand, the operator depresses the sensitive feed-lever each time a hole in the jig is aligned with the drill. Although the work-piece is advanced by hand, the operator has no trouble in aligning the holes with the drill. All five holes in each of 800 pieces are drilled in an hour.

Each cylinder-lock plug requires a slot parallel to its axis into which a key must be fitted before the plug can be turned in the assembled lock. This slot has longitudinal grooves to suit the sinuous, or wavy, section of the key. If the plug is die-cast, the slot usually is cored and does not have to be machined, since the core, which is precisely formed to the key section, produces a slot with smooth surfaces.

Some locks, however, have specifications that call for a brass plug of the type shown at the right in Fig. 1. Blanks for such plugs are turned and cut off to length in a screw machine. Since the key slot must have a sinuous section, it cannot be milled, but is produced by a broach in the special machine illustrated in Fig. 4. This broach has five sections, each 12 inches long, which are

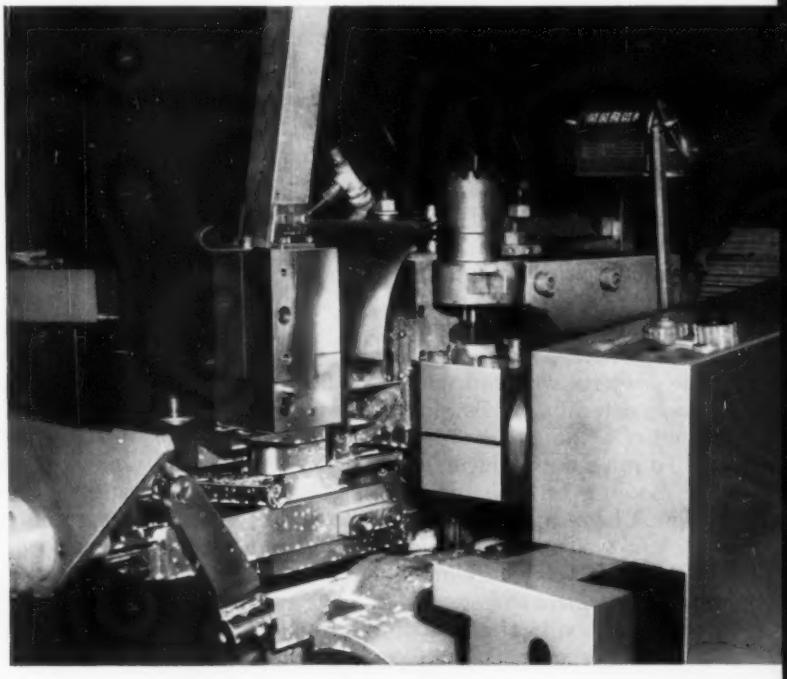


Fig. 6. In this machine, three parallel longitudinal slots are milled in stamped key blanks. Work-pieces are fed automatically from a magazine. Output averages about one key a second.

fastened securely to a rack. The rack, in turn, is mounted vertically in guides and is counterbalanced. A pinion engaged with the rack is arranged to drive it in either direction.

On the bed of the broaching machine is a holding device for the work-piece. Formerly, a fixture accommodating only one piece at a time was used and reloading was required after each return stroke of the broach. This setup, however, has been replaced by a dial type, automatically indexing fixture (Fig. 5). Each work-piece is hand-loaded between jaws that are well away from the broach, the plug being set in a vertical position. As the part is indexed beyond the loading station, the jaws automatically clamp the plug and hold it securely until after broaching. The work-piece remains at the broaching station for about ten seconds. With subsequent indexing, the slotted plugs are unclamped and released above a chute. Operation of the machine is entirely automatic except for hand loading. Average output approximates 355 plugs an hour, although 400 per hour can be processed.

Keys for cylinder locks could be die-cast, but stamped blanks are produced rapidly and stronger keys result. The grooves in stamped keys must be milled after blanking. However, since this can be done at the rate of about one blank per second in automatic machines, the cost per key is low. Key-slot milling is performed in new Davis-Thompson machines (Fig. 6) built to Yale & Towne specifications. Key blanks are fed from a hand-loaded magazine. One blank at a time is "wiped" from the bottom of a stack of keys as a recess in a reciprocating slide passes below the magazine. When the slide has advanced the work-piece to cutting position, rotating cutters, one above and one below the blank, are cammed in automatically under spring pressure and make plunge cuts to the proper depth.

When the cutters reach this depth, the slide retracts, moving the key longitudinally as the two form cutters complete three slots, one near each edge on top and one below the blank at the center. Following this, the key drops out of the recess and the slide returns to loading position. This machine is operated at 50 to 72 cycles per minute. Cutters are of high-speed steel, have sets of sixteen teeth, are 1 1/2 inches in diameter, and are rotated at 2350 rpm. Two sets of teeth on the top cutter have no rake angle and are spaced to key specifications. An ample flow of coolant washes chips away.

Subsequently, the keys are run through embossing dies and sets of blanks corresponding to each key change specified are stacked for gang notching by cross-milling.

Although many other machining operations are performed in this plant, the ones described are good examples of some that have unusual features and involve high rates of production. These setups do not sacrifice quality but have helped the company to maintain a favorable position in this highly competitive field.

Bactericide Improves Bearing Production

Breakdown of soluble-oil emulsions due to presence of bacteria is a constant problem in machine shops and production departments. Often hidden sumps, pipes, and traps exclude light and air, thus fostering the rapid growth of anaerobic, odor-producing bacteria. In addition, hydraulic and spindle oils, dirt, scale, and rust contaminate coolant with bacteria and provide the bacteria with nutrient material. This condition existed in the Bearing Division of the Torrington Co., South Bend, Ind.

To solve the problem, a bactericide, Dowicide A (sodium orthophenylphenate), made by the Dow Chemical Co., was added to the central coolant system and circulated with the coolant. The result was the elimination of troublesome bacteria which had caused staining and rusting of bearing parts after the finish-grind. The coolant adopted consists of 0.1 per cent Dowicide A, 2.5 per cent soluble oil, and 97.4 per cent water of zero hardness and iron-free.

Many other advantages are also obtained by the removal of the bacteria. Much less staining and rusting occur on all machined parts. Operators dress wheels less frequently, and because of this, longer wheel life is assured. A better and brighter finish is produced, an oily scum was eliminated from the top of the coolant in a central tank, and foaming in gutters was stopped. Machines are also much cleaner, and pumps, tanks, pipe lines, filters, and valves require less maintenance. In addition, the coolant has a longer life because it does not have to be discarded as often to eliminate the odor. The bactericide is water soluble and is safe and easy to use. It is added periodically to maintain a concentration of about 1 pound of preservative per 100 gallons of emulsion.

Checking Flatness with Straightedges

C. MINAIRE

ONE CONVENTIONAL METHOD of checking the flatness of a plane surface is to support a straightedge on gage-blocks of equal height, and then to slide a stack of gage-blocks beneath it. Next, the height of the stack is adjusted until the upper face of the top block just contacts the lower surface of the straightedge. Any difference in the heights of the two supporting blocks and the sliding gage-block combination indicates the amount by which the plane surface is convex or concave at that particular position.

The accuracy of this method of checking flatness is affected by the deflection of the straightedge, and the deflection is at a maximum when the straightedge is supported at its extremities. For a plain steel straightedge, of length L and depth d, the maximum deflection f may be calculated from the formula:

$$\sqrt{f} = \frac{7.682\ L^2}{200{,}000\ d}$$

Alternatively, for a given deflection, the depth of the straightedge may be obtained from the formula:

$$d = \frac{7.682\ L^2}{200{,}000\ \sqrt{f}}$$

The deflection of a straightedge of constant depth is substantially reduced if the straightedge is supported at points located a distance from either end equal to 0.211 times the length of the straightedge. By supporting the straightedge at these positions, the deflection is reduced to approximately one-fifth of the amount when it is supported at its extremities. Deflection can be further substantially reduced by employing a cross-section of I-form. For example, the deflection of a steel straightedge of I-section is about 0.00020 inch when it is supported at its ends. A similar straightedge of rectangular section has a deflection of 0.00040 inch. By supporting the I-section straightedge at the points of minimum deflection, the deflection is reduced to only 0.00004 inch.

Wedge-Blocks for Checking Flatness

In view of the possibility of wear of the gage-blocks, and the time that is required to make up the various gage-block combinations, it is desirable to employ a set of three special blocks, similar to those shown in Fig. 1. There are two blocks of the type indicated at *A*, of exactly the same height and approximately the same length and width. The top and bottom surfaces of these two blocks are finished so that they are accurately parallel.

The third block *B* is about the same width, but longer, and its upper face *C* is finished to provide a taper of 0.0025 inch per inch, relative to the lower face. At a position approximately midway along the length of the taper, the height of block *B* is exactly the same as blocks *A*. This position is indicated by an engraved line, and a

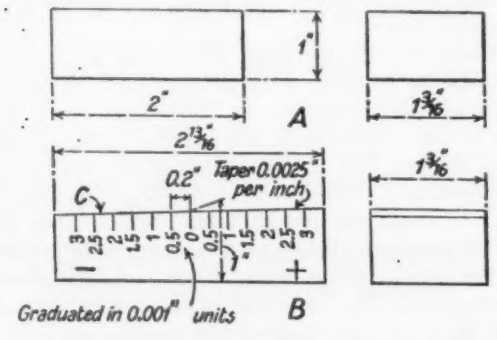
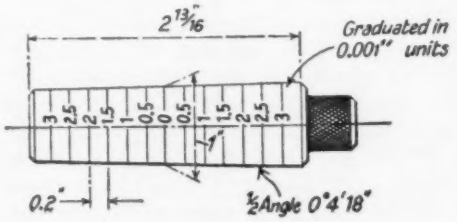


Fig. 1. Support blocks (A) and a calibrated wedge (B) for use with straightedges in checking plane surfaces.

Fig. 2. Wedge (B) shown in Fig. 1 can be replaced by this calibrated taper plug for more precise measurements.

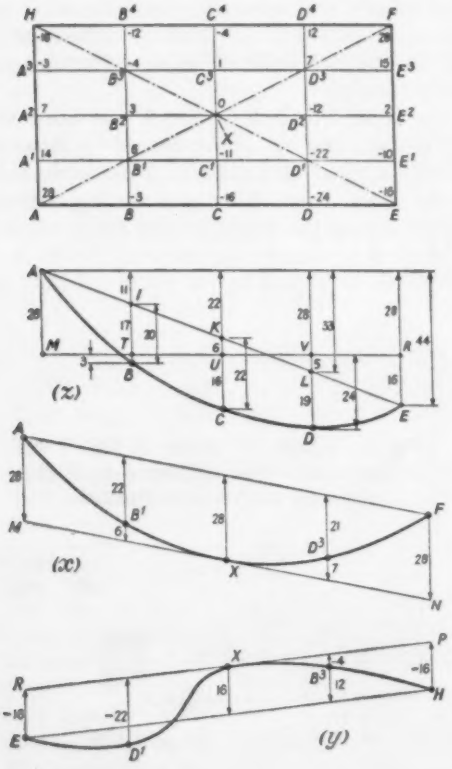


zero mark is provided on both side faces. Both of these faces are also calibrated in equal increments of 0.2 inch, on either side of the zero mark, and the rise of the sloping face between adjacent calibrations is exactly 0.0005 inch.

For checking the flatness of a plane surface, the two blocks *A* are employed to support a straightedge. The tapered block is then slid under the straightedge at various positions until it just makes contact. At each position, the relationship of the engraved scale to the straightedge indicates the amount by which the surface is convex or concave. This amount can be read directly in units of 0.0005 inch, and fractions of a unit can be estimated.

A plane surface may be checked more efficiently when the measurements are localized. For this purpose, the wedge-block is replaced by a tapered plug, such as the one shown in Fig. 2. The diameter of the plug at the midpoint along its length is made equal to the thickness of the blocks *A* (Fig. 1). The plug has a taper of 0.0025 inch per inch (that is, a half-angle of 0 degree, 4 minutes, and 18 seconds).

Fig. 3. Application of grid lines to a surface plate (top view) facilitates checking for flatness. The three lower views show profile of plate along diagonals and one side.



Checking the Flatness of a Surface Plate

When a straightedge is used to check the flatness of a surface plate, the plate should be divided into zones of equal area by means of thin lines of crayon or paint, as indicated in the upper view of Fig. 3. The center-point *X* is arbitrarily fixed as the datum or zero position. A straightedge is applied successively along the diagonals *AF* and *EH*, in the manner described. Then, by taking measurements at the intermediate points along each diagonal, the sections of the surface plate along these lines can be checked.

For example, applying the straightedge along the diagonal *AF*, the heights of the points *A*, B^1, D^3, and *F*, relative to the zero-point *X*, can be determined. From these dimensions, a section of the surface plate relative to a datum line *MXN* can be drawn, as indicated in view (*x*). The line *MXN* passes through the zero-point *X*, and is parallel to a line passing through the points *A* and *F*, this latter line being parallel to the lower face of the straightedge. The distances of point *A* from point *M*, and point *F* from point *N*, are equal to the differences in the height of the straightedge from the zero-point and the heights of the supporting blocks. This distance, in the example under consideration, is 28 units. From the measurements taken for the points B^1 and D^3, the distances of these points from the line *MXN* can be found by subtraction (in this instance, 6 and 7 units, respectively).

In a similar manner, the section of the surface plate along the diagonal *EH* can be plotted. The distances of the points *E*, D^1, B^3, and *H*, relative to the line *RXP*, can be found, as indicated in the view (*y*). In this instance, since all the points lie below the line *RXP*, the values are prefixed by a minus sign.

From the datum lines *MXN* and *RXP*, it is possible to establish a datum plane which passes through the zero-point *X*. The diagonals of this plane, by construction, are parallel to the diagonals *AF* and *EH* of the surface plate. Moreover, the distances of the points *A*, B^1, D^3, *F*, *E*, D^1, B^3, and *H*, from the datum plane, which have already been established may be marked on a plan of the surface plate, using the minus sign where appropriate. This is shown in the upper view of Fig. 3.

The distance of each of the points *B*, *C*, and *D* from the datum plane is determined by applying the straightedge along the line *AE*. From the dimensions obtained, the distances of these points

from the side *MR* of the datum plane can be established as follows. The point *A* is 28 units above the datum plane, and the point *E* is 16 units below the datum plane. Therefore, the difference in height between the point *A* and the point *E* is 44 units, as indicated in view (*z*). The heights of the straightedge relative to the datum plane at positions *B*, *C*, and *D* are indicated by *IT*, *KU*, and *LV*, respectively. Since the points *B*, *C*, and *D* are equally spaced along the length of the line *AE*, the distances of the points *I*, *K*, and *L* from the line *MR* are equal to the distance of the point *A* from this line (28 units) less $44 \times 1/4$, $44 \times 1/2$, and $44 \times 3/4$ units, respectively. Hence, $IT = 28 - 11 = 17$ units; $KU = 28 - 22 = 6$ units; and $LV = 28 - 33 = -5$ units. The minus sign that prefixes the latter value indicates that the point *L* is below the datum plane.

In view (*z*), the actual distances measured between the straightedge and the points *B*, *C*, and *D* are indicated at *IB*, *KC*, and *LD*, respectively. The corresponding measured values are 20, 22, and 19 units. By subtracting the values calculated for *IT*, *KU*, and *LV*, the distances *TB*, *UC*, and *VD* of the points *B*, *C*, and *D* from the datum plane can be obtained, thus:

$$TB = IT - IB = 17 - 20 = -3 \text{ units}$$
$$UC = KU - KC = 6 - 22 = -16 \text{ units}$$
$$VD = LV - LD = -5 - 19 = -24 \text{ units}$$

The deviation of each of the points *B*, *C*, and *D* from the datum plane is indicated on the plane of the surface plate (upper view, Fig. 3). A similar procedure is employed to find the deviations of the other points, which, in turn, are plotted on the plan.

From the information thus obtained, it is possible to construct a diagram which indicates the topography of the surface plate that is being checked. Such a diagram for the plate under discussion is reproduced in Fig. 4, where the outline of the plate is indicated by heavy lines. In this diagram, the surface that is being checked is denoted by the letters *AHFE*, and the datum plane *MPNR* is shaded. This datum plane is parallel to the diagonals *AF* and *EH*, but it is not parallel to the base of the surface plate, indicated by *JZYG*. Deviations of the various reference points on the surface plate from the datum plane are noted on the diagram.

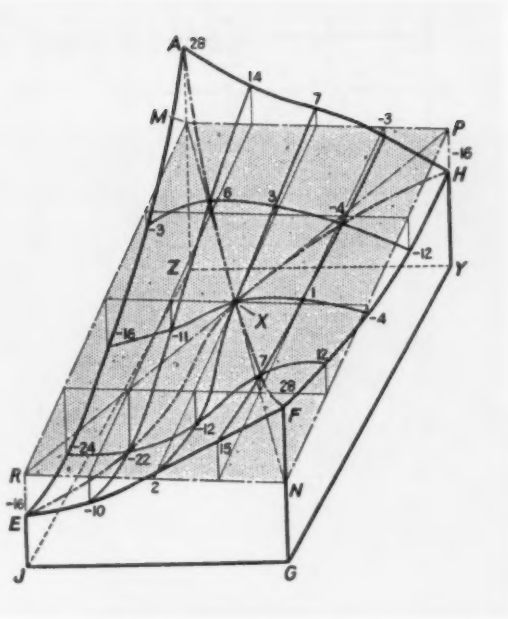


Fig. 4. Chart indicating topography of surface plate. The datum plane, which is not parallel to base of plate, is shown shaded, and deviations of various points are given.

Obtaining a True Plane Surface with the Minimum Removal of Material

The adjustment of a surface plate by scraping or lapping, to provide a surface that is a true plane, can be costly and time-consuming unless steps are taken to insure that only the minimum amount of metal is removed. Before the actual adjustment operations are begun, it is advisable to plan the work on paper, using the data obtained from a series of checks of the type that have been outlined. From these data, it is necessary to select a final plane, and to prepare a chart indicating the amounts of metal to be removed in order that this plane may be achieved. Then a check should be made to insure that this plane can be obtained with the removal of the least amount of metal.

In certain instances, the final plane can be selected intuitively, and often there appear to be two or more planes which would give the same final result. Usually, however, it is only after a number of preliminary investigations have been made on paper that the most effective solution can be found. If an addition is made of all the deviations of the reference points of the actual surface of the plate from the proposed plane, for each final plane under consideration, the best choice will be indicated by the lowest total.

Considering the example that has been discussed, it will be apparent that one possible final plane would be parallel to the datum plane *MPNR*, and would pass through the point *D*, Fig. 3, which is 24 units below the plane. To produce this final plane, it would be necessary to remove varying amounts of metal from the different areas of the surface plate. The depth of metal removed from the plate at the point *A*

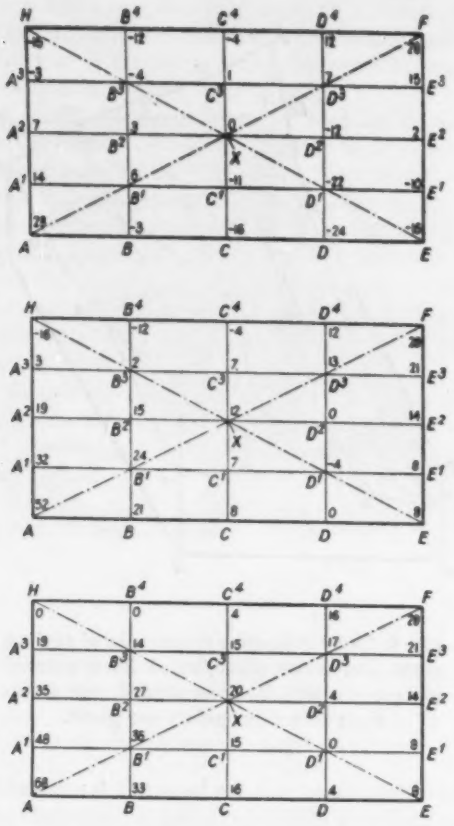


Fig. 5. Charts showing deviations from various datum planes. Lower chart indicates deviations from final plane established to permit minimum stock removal in adjusting.

would be $28 + 24 = 52$ units; at the point H, $-16 + 24 = 8$ units; at the point D^2, $-12 + 24 = 12$ units; and so on. The total depth of metal to be removed at all the reference points would be 570 units.

If a plane was chosen that passed through the point A (one of the highest) and the points D and H (the two lowest), the total depth of metal to be removed, by a coincidence, would also be 570 units. It is obvious that none of the deviations of the actual surface of the plate from the final plane (at the various reference points) can have a minus value. In the selection of the final plane, it is of advantage to consider a plane passing through the points F, H, and E, since the point F is one of the two highest on the surface of the plate. Also, points H and E are located on lines which pass through the lowest reference points, relative to the datum plane.

Next, it can be assumed that the plane FHE is tilted, like a hinge, about the points F and H, until it passes through the point D, which is the lowest point of the surface of the plate. The plane then becomes the plane FHD, and it is necessary to calculate the deviations of the various reference points on the surface from this plane. For the sake of convenience, the deviations of these reference points from the original datum plane are shown in the upper view of Fig. 5.

Since the plane was pivoted about the points F and H, the deviations along the line FH will remain unaltered. The deviations of the points along the lines A^3E^3, A^2E^2, A^1E^1, and AE will be modified by the addition of $24 \times 1/4$, $24 \times 1/2$, $24 \times 3/4$, and 24 units, respectively. The modified deviations obtained in this way are indicated in the middle view of Fig. 5.

Next, it is necessary to imagine the new plane FHE pivoted about the points F and E, until it passes through a point that is 16 units below the point H. The deviations of the various reference points are corrected by adding to them the required proportions of the 16 units, depending on their distance from the line FE. The final deviations of the reference points are indicated in the lower view of Fig. 5. These values represent the amounts of metal that must be removed at each of the points to establish the final plane. By adding the values shown, the total amount of metal that must be removed is indicated. In this instance, the total amount is 470 units.

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Improved Ceramic Tool

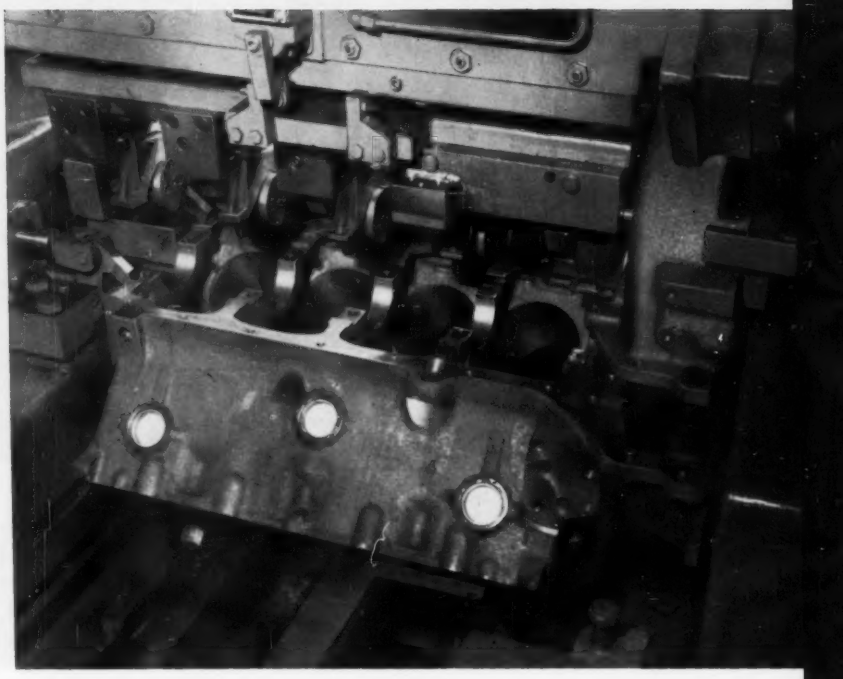
An improved ceramic tool material, VR 97, has recently been introduced. Offered in five standard sizes of throw-away bits, it is being manufactured by the Norton Co. and sold through the Vascoloy-Ramet Corporation.

Considerably longer life is claimed for this tool over its now discontinued predecessor VR 95. Additional operations can be handled such as machining fully hardened steel, finish-cutting cast iron and, in some instances, rough-cutting cast iron. Many operations involving interrupted cuts can be completed even though material hardness runs as high as 62 Rockwell C. Other successful tests were made on SAE 4340 and 5040 steels at 50 Rockwell C, and on chilled cast iron at 60 Rockwell C.

Unfortunately, the picture is not this bright in all cases. Stainless steel and high-temperature alloys still are difficult to machine with ceramics. Although tests on these materials using VR 97 tools showed better performance than with previous ceramics, there is a need for additional improvement in this area.

Automatic Engine Assembly on Transfer Machines

In-line, indexing type transfer machines are being used for completely automatic and semi-automatic assembly of components to Oldsmobile V-8 Rocket engines. One of the innovations is the automatic assembly of camshafts into the cylinder blocks.



CHARLES H. WICK, Managing Editor

INCREASING DEMAND for Rocket V-8 automotive engines is being met at the Oldsmobile Division of General Motors Corporation, Lansing, Mich., by performing assembly operations automatically and semi-automatically on in-line, indexing type transfer machines.

Engine blocks from the production machining lines are automatically unloaded from monorails and placed on a roller-flight, power-and-free conveyor. This conveyor carries the blocks to a Natco fifty-one-station, in-line type transfer machine. The blocks are automatically loaded at the first station, and indexed periodically to successive stations along the machine. Transfer is accomplished by means of two reciprocating and pivoting bars having fingers for pushing the blocks along slides.

At Station 5, the five main bearing caps and lower housing previously attached to each block for machining are loosened for subsequent disassembly. This is accomplished automatically by backing-out the fourteen bolts with an Ingersoll-Rand multiple-spindle unit equipped with air-operated wrenches. The caps and housing are automatically removed from each block by means of a Natco unit at the ninth station, seen in the heading illustration. Carriers are suspended from a separate overhead monorail to convey the caps and housings to Station 33, where they are reassembled to the blocks.

Oil galleries are blown out at the twelfth station. It is planned that when the block has been indexed to Station 15, two pipe plugs will be automatically assembled. A unique machine, developed and built by A. E. Parker & Sons Co., Howell, Mich., has been provided at the eighteenth station, Fig. 1, to automatically assemble a camshaft into each cylinder block. After final polishing, the camshafts are not touched, thus eliminating any possibility of damage to the finely finished lobe and journal surfaces on the shafts. Also, the machine inserts the camshafts without allowing the cam lobes to gouge the babbitt bearings—as often happened with manual loading.

Polished camshafts are automatically transported through a washing operation, and then by overhead monorail conveyor to an inclined storage rack on the Parker assembly machine. Escapement and chain carrying mechanisms

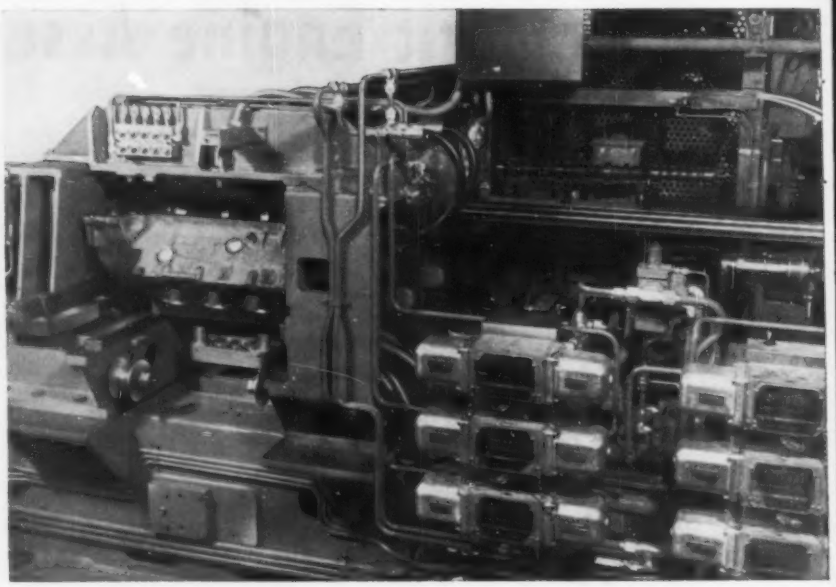


Fig. 1. Machine for automatically assembling camshafts into cylinder blocks without having the camshaft lobes contact the babbitt bearings in the block.

lower the shafts, one at a time, onto V-blocks, which elevate each shaft to the height of the camshaft bore in the block, Fig. 2.

Meanwhile, an engine block is raised and clamped against a locating pad that contains pins which enter manufacturing holes provided in the block. A bullet-nosed, floating pilot-bar enters from the rear of the block and passes through the cam bearings to become aligned with the cam bore in the block. As the bar emerges from the front end of the block, it passes through a set of open guide jaws, and a center on the end of the pilot-bar picks up a center hole in the end of the cam.

Continued advance of the pilot-bar pushes the camshaft into the floating head of a driving bar. When the V-blocks are lowered, the camshaft is supported between centers on the pilot-bar and driving head. Then, the guide jaws close and align themselves with the pilot-bar and are locked in place. Simultaneously, the driving head starts rotating, to pick up and position the camshaft gear pin, and then is fed forward to push the camshaft through the guide jaws into the cam bearings in the block.

In this way, the camshaft is assembled into the block while one end is being supported by the pilot-bar (which has aligned itself with the bearings), and the other end, by the guide jaws (which have aligned themselves with the pilot-

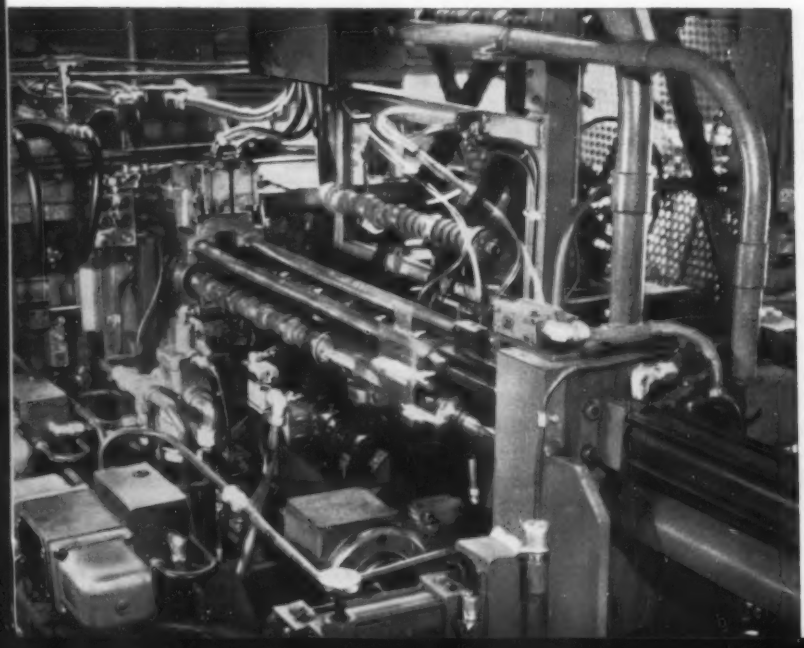


Fig. 2. Close-up view of camshaft assembly machine (Fig. 1) prior to installation in the line. Shafts are lowered by chain carrying mechanism onto V-blocks, which raise the blocks to proper height.

bar). Thus, even the slight errors resulting from manufacturing tolerances do not affect the assembly operation. Although clearances as small as 0.0015 inch are encountered, the babbitt bearings are never contacted by the camshaft lobes or scored by the journal surfaces. As a result, the assembled camshafts can be rotated freely by hand—a feat never achieved with previous hand-assembly methods.

While the driving head is being fed forward, it is also rotated two revolutions. This rotary motion facilitates entry of the journal surfaces into the bearing bores, and makes it possible to spray a uniform film of oil onto the camshaft as it enters the block. Rotation of the camshaft automatically stops with its timing-gear dowel-pin in the down position to facilitate subsequent assembly of the timing gear and chain. When the camshaft has been pushed all the way into the block, the guide jaws open, the pilot-bar and driving head return to their starting positions, the block is unclamped, and another camshaft is lowered by the chains onto the V-blocks—ready for the next cycle. Limit switches insure that a camshaft has been lowered into position and elevated before the assembly cycle starts. Complete cycling time, including clamping and unclamping of the cylinder block, is 12 seconds. At Station 20 an automatic sealer applicator is under construction. This will apply sealer to three holes in the rear of the block.

Rear crankshaft oil seals and bearing shells are manually assembled to the engine block at Station 23. Hopper feeding devices and press units are under construction for the twenty-fourth station to automatically assemble the oil gallery and rear camshaft welch plugs, as well as two front dowels. Crankshafts are automatically assembled at the twenty-ninth station, and the bearing caps and lower housing are loosely assembled by hand at Stations 33 and 34. Bolts for securing the lower housing and bearing caps are automatically tightened by means of nut-runners on a twelve-spindle, Ingersoll-Rand unit at Station 37.

The timing key and gear are loosely assembled, and an inspection plate is assembled and secured to each block at the forty-first station. Manual assembly of the chain and sprocket is performed at Station 45. At the last working sta-

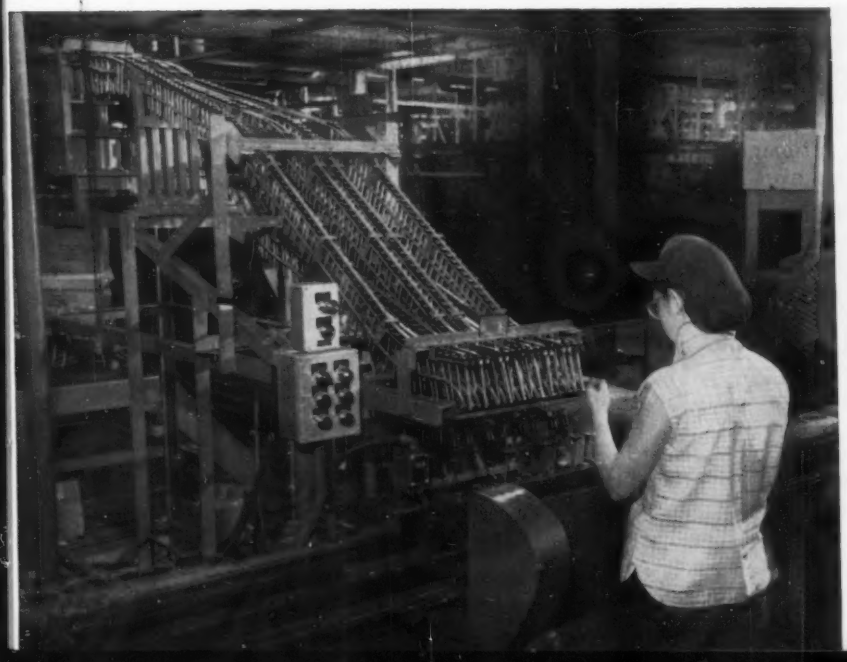


Fig. 3. (Above) Connecting-rod nuts are automatically positioned on engine-block assembly, and driven to a preset torque with this eight-spindle nut-running unit.

Fig. 4. (Left) Intake and exhaust valves are manually loaded, and automatically positioned and assembled in cylinder heads at second station of transfer machine.

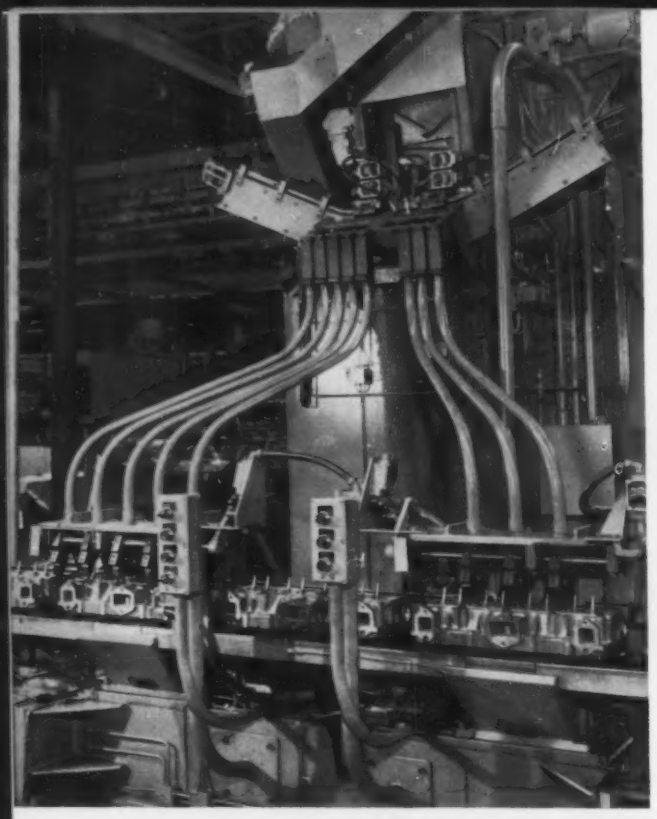


Fig. 5. Storage unit, elevator, and chutes are employed at the fourteenth and sixteenth stations to position long bolts, prior to assembly in heads.

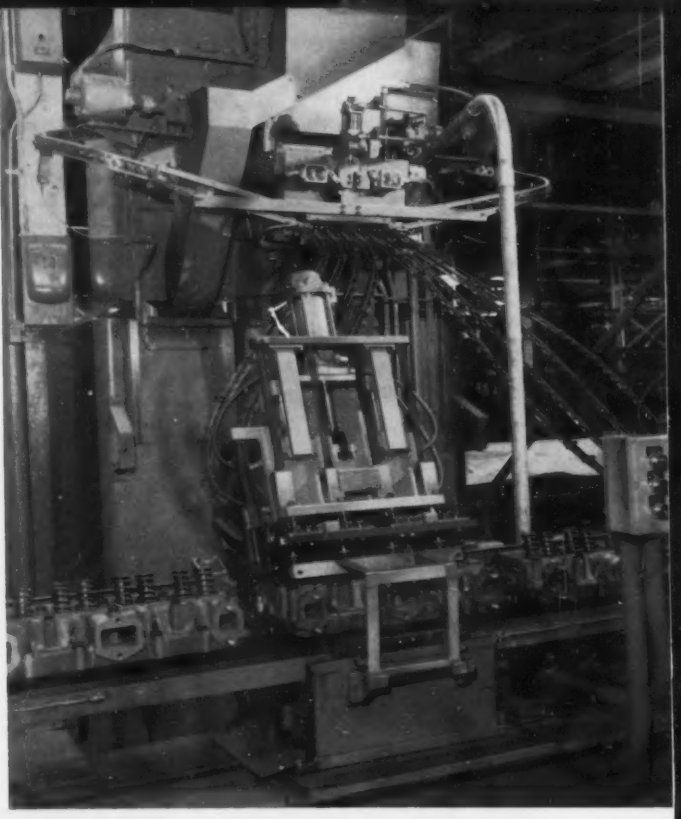


Fig. 6. Eight spring retainers are automatically assembled onto the valve springs at Stations 40 and 42. Station 42 is at right and not visible.

tion, the eccentric and starter stud are assembled. Idle stations are provided at various locations along the transfer machine for back-up operations, to maintain production in case of failure of an automatic station. In progressing through this machine, the weight of each engine block is increased from 235 to 340 pounds.

Engine blocks are automatically transferred to a Natco twenty-nine-station, in-line machine by means of unloading, elevating, and loading units. At the fifth station on this second assembly machine, the crankshaft in each block is automatically positioned and sprayed with oil. A separate, overhead monorail conveyor is provided over the machine. From this conveyor are suspended piston and rod carriers.

The piston and rod assemblies, together with caps and nuts, are assembled to the block at various stations along the machine. Connecting-rod nuts are automatically fed and driven by Ingersoll-Rand, eight-spindle units equipped with air-operated nut-runners, Fig. 3. From this second automatic assembly machine, the engine blocks are transferred to final assembly and test.

Cylinder heads for the V-8 engines are also assembled automatically and semi-automatically on an in-line transfer machine designed and built by the Process Development Section of General Motors in collaboration with Oldsmobile engineers. This machine is 140 feet long and contains sixty-seven stations. The heads are indexed from station to station by pusher bars that are actuated by linkage connected to an electric motor driven, geared speed reducer.

Indexing requires 2 seconds, and there is a 7-second dwell at each station—providing a cycle time of 9 seconds, or a production of 400 heads per hour at 100 per cent efficiency. The cylinder heads are mounted on pallets while they are being transferred through the machine, and the pallets are accurately located at each station by air-actuated shot pins which enter the pallets. A sufficient number of idle stations have been provided to permit manual assembly of the heads if required.

Intake and exhaust valves are stripped from packaging separators onto rail slides leading to the second station on the machine, Fig. 4. Here, an operator manually loads eight valves at a time into a fixture which automatically positions the valves over a cylinder head. Then, the valves are pneumatically inserted into the head.

At Station 6, the cylinder heads are automatically turned upside down and placed on the assembly pallet by means of a lever-operated pivoting arm, actuated by an electric motor driven, geared speed reducer. Four spark-plug gaskets are automatically assembled in each head at the eighth station, the gaskets being delivered from a Moore bowl type, vibratory feeding unit with timed air blasts, and assembled into the head pneumatically.

An operator manually loads a spark plug into each of four Cleco, air-operated nut-setters at Station 10. Plugs are fed to the operator's position by conveyors, and the nut-setters automatically tighten the plugs to a pre-set torque. At the twelfth station, sealer is automatically discharged into the pipe-plug hole and lower stud holes in each cylinder head.

At Stations 14 and 16, Fig. 5, a total of eight long bolts are automatically fed into each cylinder head. The bolts are supplied from a Feedall 45-cubic-foot storage unit, equipped with an inclined elevator that carries them up to the entry ends of the delivery chutes. Pivoted gripping fingers receive the bolts, one at a time, and release them in the heads. Air-operated nut-setters are provided at Stations 18, 20, and 24 to drive two lower studs, two upper studs, and one pipe plug into each head. The studs and plugs are automatically fed from vibratory hoppers. Four short bolts are automatically hopper-fed and positioned in each head at the twenty-second station.

Eight oil deflectors are automatically fed into position from hoppers, and pneumatically pressed onto the valve stems in each cylinder head at the thirtieth station. Valve springs are manually assembled to the head. At Stations 40 (Fig. 6) and 42 (to the right, not shown), eight spring retainers are automatically assembled onto the valve springs on each head. The retainers are delivered from a Feedall storage unit by means of an elevator and gravity chutes.

One of the most difficult cylinder-head assembly operations to automate was the installation of the split keys, or spring keepers, on the valve stems. However, this problem has now been solved, and eight keys are assembled at each of four stations. Two of these stations (49 and 50) are shown in Fig. 7. The other two stations are used for backup. The keys are automatically supplied from overhead, vibratory feeding bowls, which are kept filled to a pre-set level by a bulk feeding bin. From the bowls, the keys slide down chutes to air-operated units which compress the valve springs and position the keys on the valve stems.

An automatic, air-operated probing unit is provided at Station 52 to detect any faulty key assemblies. If such an assembly is found, it is repaired at the fifty-fourth station, which is equipped with a manually controlled, air-actuated unit. Completed cylinder heads are automatically removed from the pallets and manually unloaded from the assembly machine at Station 67.

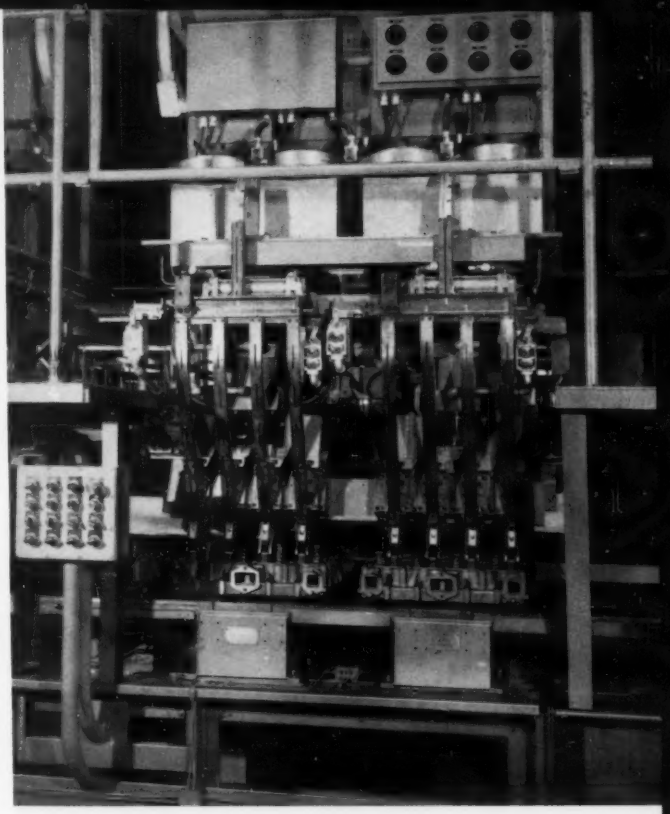


Fig. 7. Setup used for the difficult operation of automatically assembling split keys (spring keepers) on valve stems. Springs are compressed prior to assembly of keys.

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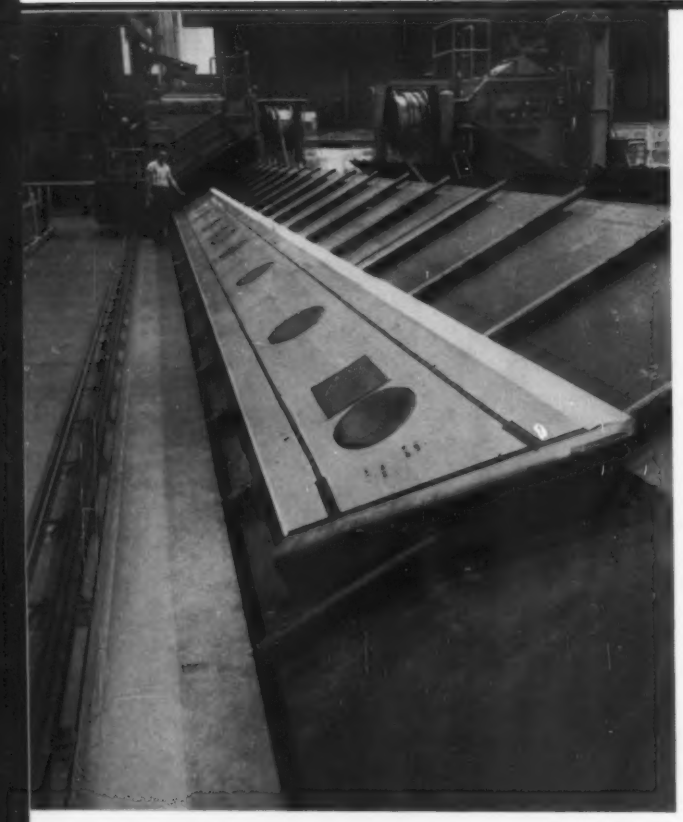
Static Controls Applied to Spark-Plug Assembly Machine

The application of static control to a spark-plug assembly machine at the AC Spark Plug Division of General Motors Corporation, Flint, Mich., is expected to increase the productivity of this equipment 10 to 15 per cent by reducing its down time. Since they have no moving parts, static control logic elements possess an exceptionally long life expectancy.

A product of the Helfrecht Machine Co., Saginaw, Mich., the spark-plug assembly machine uses a control composed of 127 General Electric static control logic elements. Monitor lights provide a quick and accurate means of checking machine operation.

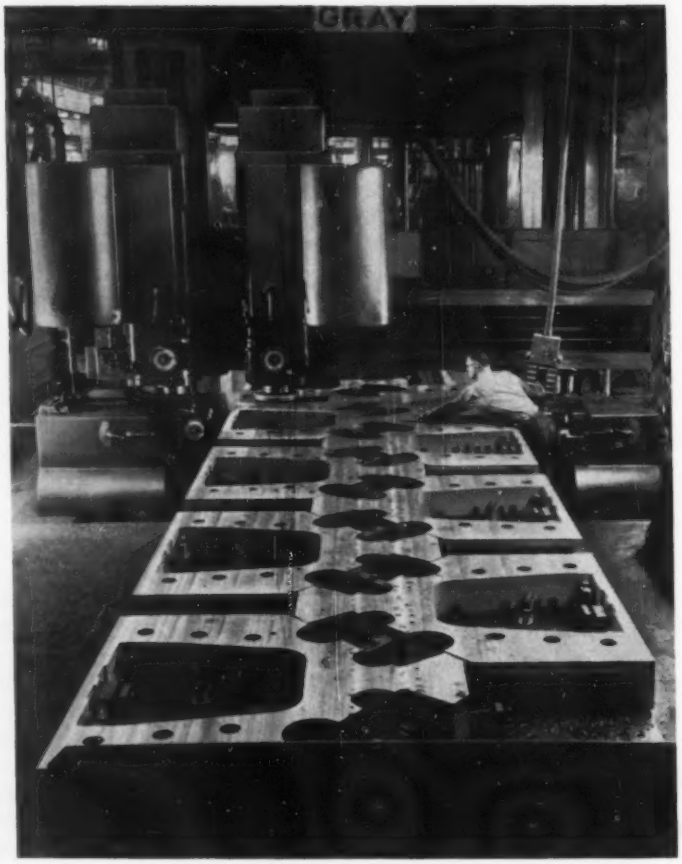


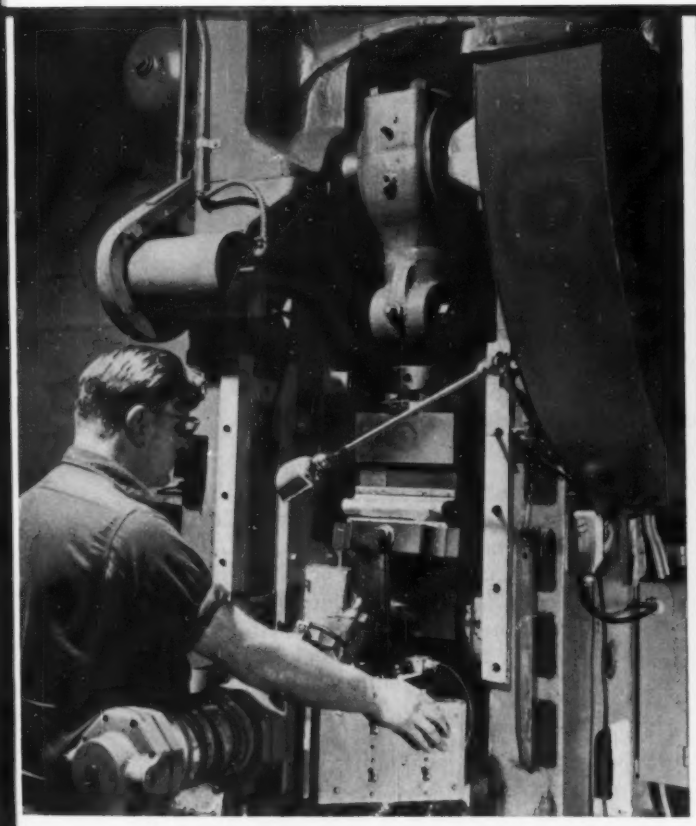
IN SHOPS AROUND THE COUNTRY

Camera highlights of some interesting operations performed in various metalworking plants throughout the nation

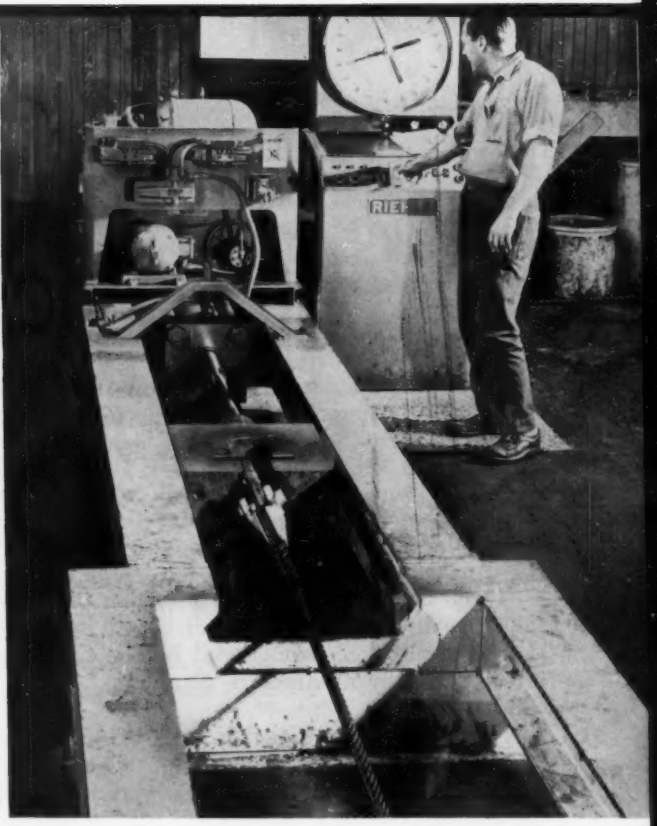
SHOOTING GALLERY—(Above) An integrally stiffened panel for a B-53 global bomber is shot-peened at Boeing Airplane Co.'s Wichita plant. The "Peenamatic" fires steel shot at the work by compressed air from ten nozzles on a moving carriage. Force of the shot develops a contour in the panel and hardens the material. Peened surface is smooth enough to be finished without further milling. Masked sections are where contouring is not desired.

PRESS REVIEW—(Right) This planer type milling machine, one of the largest in the east, is installed at R. Hoe & Co., Inc., Dunellen, N. J., a manufacturer of printing-press equipment. Nine printing-press side frames occupy the machine's 8- by 28-foot table. The table can be split into two 14-foot sections, making it possible to machine work on one section and set up or remove work from the second section at the same time.



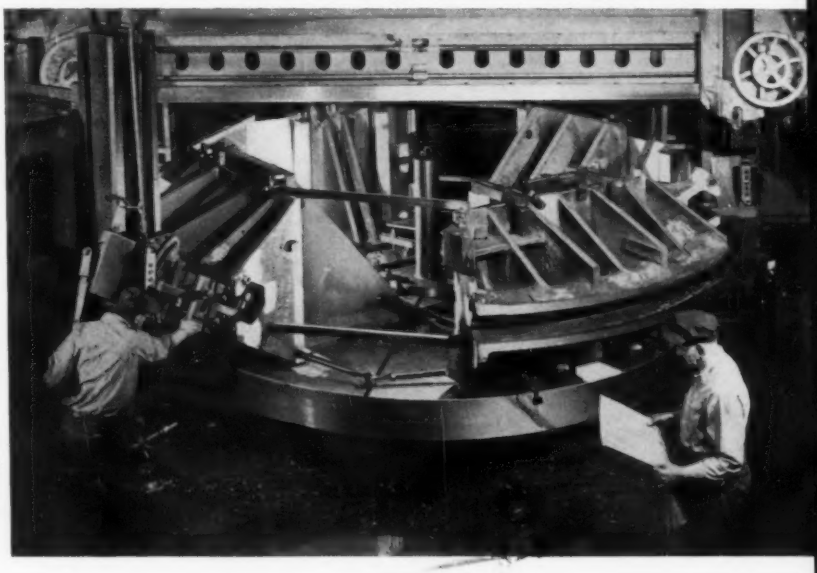


BLADE PINCHER—Compressor blades and vanes for gas turbines in Navy helicopters are produced by this new "roll and coin" process, at General Electric Co.'s Small Aircraft Engine Department, Lynn, Mass. Heated extrusion is pinched between two roll dies, which then revolve and form the blade. Process represents a cost reduction of 50 per cent over any other known method of blade manufacture.



TUG OF WAR—A tremendous pull is exerted on wire-rope ends by a 60-ton tensile testing machine, at the New Haven, Conn., works of U. S. Steel Corporation's American Steel & Wire Division. The machine is used to gage the holding power of spliced ends and swaged end-fittings of elevator and other wire rope. On another machine, rope is run back and forth over a sheave repeatedly to test bending life.

SADDLE SHOP—Suspension cables on the new St. Lawrence Seaway Bridge at Rooseveltown, N. Y., will ride in the four cast-steel tower saddles set up on this 16-foot boring mill in the Wheeling, W. Va., plant of Blaw-Knox. The castings, weighing 7455 pounds each, are machined simultaneously. Complicating the job is the slight angle at which grooves must be cut to fit cable contour.



MATERIALS

The properties and new applications of materials used in the mechanical industries

Easily Formable, High-Strength, Beta Titanium Now Available

Three high-strength, easily formable titanium alloys available in sheet, wire, and small bar form have recently been announced by the Crucible Steel Company of America, Titanium Division, Midland, Pa.

The first, called "Crucible B-120VCA" is, according to the producer, the only beta-titanium alloy commercially available. It is a versatile alloy in that it has high strength, is cold-headable, can be formed readily, and made very hard to a great depth. The nominal composition of this alloy is: vanadium, 13 per cent; chromium, 11 per cent; aluminum, 3 per cent; and titanium, the balance. In the formable condition it has a minimum yield strength of 120,000 psi which can be increased by aging (20 to 100 hours at 850 to 950 degrees F.) to 170,000 to 200,000 psi with good residual ductility.

The second, designated "Crucible C-105VA" is an alpha-beta type titanium-base alloy containing a nominal alloy content of 16 per cent vanadium and 2.5 per cent aluminum. In addition to its high strength and formability, it is ageable to high strengths while maintaining ample ductility, and is weldable. Welds can be solution heat-treated and then aged to base metal strengths and ductilities. Typical properties of the sheet form include an ultimate tensile strength of 110,000 psi, a yield strength of 55,000 psi, an elongation in two inches of 18 per cent, and a reduction in area of 36 per cent.

The third, called "Crucible C-115AMoV," nominally containing 4 per cent aluminum, 3 per cent molybdenum, and 1 per cent vanadium is capable of being solution heat-treated to a soft, easily formed condition. It can later be aged to a high strength with accompanying useful ductility. Other advantages attributed to this alloy include a good creep resistance under moderate

These nineteen die-castings which contain many studs, bosses, holes, recesses, and gear and ratchet teeth comprise the principal structural components of a line of lawn mowers recently made available by Clemson Bros., Inc., Middletown, N. Y.

stresses up to 800 degrees F., good time-temperature-stress stability, and aging characteristics which are not affected by forming in the solution heat-treated condition prior to aging. Its typical solution heat-treated properties at room temperature are an ultimate strength of 140,000 psi, a yield strength of 90,000 psi, and an elongation of 16 per cent in 2 inches. Subsequent aging gives the following typical properties: ultimate strength, 190,000 psi; yield strength, 168,000 psi; and an elongation of 8 per cent in 2 inches.

Small Sizes of Nylon Tubular Bar Now Available

Small sizes of "Nylatron GS" nylon tubular bar ranging in outside diameters from 3/8 inch to 2 inches have been announced by the Polymer Corporation of Pennsylvania, 2140 Fairmont Ave., Reading, Pa. This formulation, which is a molybdenum-disulphide-filled nylon, has a high modulus of elasticity, a high distortion temperature, and low thermal expansion rate. The material can be used for close-tolerance fabrication of rollers, bearings, seals, washers, spacers, pipe unions, valve seats, gears, insulators, and other wear parts.

Liquid Wax that Prevents Atmospheric Corrosion

A product formulated to protect metal surfaces during inside storage and short periods of outside storage has been developed and marketed by S. C. Johnson & Son, Inc., Racine, Wis. This product, which can be applied by dipping, rolling, brushing, or spraying, can also be removed by wiping with hydrocarbon solvents. It has a low viscosity and a flash point above 100 degrees F. The film dries tack-free in 20 to 30 minutes at room temperature. Called "Johnson's Wax-Plate #6143," it has been used for coating metal springs, taps, machined parts, hand tools, and metal and chromed parts of motor vehicles and appliances.

Vinyl Material That Can Be Bonded to Metal

A semi-rigid vinyl sheeting for vinyl-to-metal applications has been announced by the General Tire & Rubber Co., Akron, Ohio. It is being made in a wide variety of thicknesses, colors, and embossings. Known as "Boltaflex 500," this vinyl will resist wear, staining, cracking, chipping, peeling, delamination, atmospheric and salf-water corrosion, fire, and other causes of deterioration.

The plastic can be bonded to metal by conventional methods and is available in 0.010-, 0.012-, 0.014-, and 0.020-inch thicknesses in widths of 36, 48, and 72 inches. It is available in six colors and many embossings.

Non-Corrosive Soldering Flux for Steels and Other Alloys

An organic-base flux that is highly active yet non-corrosive is presented by Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn 22, N. Y. Called "Anchor No. 302," it is used to remove oxides from stainless steel, steel, nickel, and nickel-chromium alloys, thus facilitating soldering of these metals. The flux and its residue will not attack the metal. It is supplied in a ready-to-use concentrated form which leaves a tacky residue that can later be wiped off. Previous dilution of the flux will eliminate the formation of a residue.

Ingredient in Skin Lotion Prevents Spotting of Metal Parts

A corrosion-resistant ingredient which prevents spotting of highly finished metal surfaces by workers' perspiration in fingerprints is contained in a skin lotion made by Milburn Co., 3246 E. Woodbridge, Detroit 7, Mich. Called "Milburn's Ply No. 9 Liquid," this anti-corrosion factor is dispersed in a water-soluble plastic film which is deposited on the skin by evaporation. The deposited film on the workers' hands is impervious to kerosene and petroleum type cutting oils and solvents. The skin lotion was developed to meet spotting problems encountered in machining and inspection operations on delicate metal parts such as bearings, aircraft instrument and electronics parts, and parts for plating.

Iron-Based Alloy Featuring Good Strength-to-Weight Properties

A precipitation-hardening iron-based alloy with good strength-to-weight properties has been made available by the Metallurgical Products Department of the General Electric Co., 11177 Eight Mile Road, Detroit 32, Mich. This alloy, designated "J-1300," has a high strength-to-weight ratio in the 1300-degree F. range. Its rupture strength at 1300 degrees F. is comparable to, or better than, other iron-based alloys at 1200 degrees F., and the minimum guaranteed tensile strength at 1200 degrees F. is 135,000 pounds per square inch. It is ductile and easily forgeable between the temperatures of 1700 and 2100 degrees F.

The alloy maintains high residual strength even after long exposure to stress at high temperatures. Like other vacuum-melted alloys it is essentially free of inclusions, impurities, gases, and oxides. It is supplied in the form of forgings

and bar stock. Applications include such jet-engine components as turbine wheels, rings, shafts, and compressor wheels and blades.

Color-Coded Gasket Material that Resists Oils and Greases

A shim and gasket material called "Color-Plast" which is color coded to identify the different thicknesses available has been introduced by General Gasket, Inc., Middletown, Conn. The material is impervious to oils and grease, even at elevated temperatures. It will not swell or become distorted after long use.

Color-Plast comes in either roll or sheet form in 12 thicknesses ranging from 0.001 to 0.030 inch, each with a distinctive identifying color. This color coding makes assembly of gaskets and shims simple because no micrometers or calipers are needed to obtain the correct thickness. Applications include bearing-cap shims, milling machine spacers, and hydraulic cover gaskets.

Brazing Alloy that Has High Strength and Oxidation Resistance

A high-temperature service brazing alloy that features high strength and oxidation resistance has been introduced by the Stainless Processing Division of Wall Colmonoy Corporation, 19345 John R St., Detroit 3, Mich. Designated "Nicrobraz 150," it is a nickel-base material containing chromium borides, and is suited for use in the fabrication of such parts as turbine blades, rotor shafts, and highly stressed sheet-metal structures.

The material is available in the form of powder, paste, and plastic-bonded wire and rod. Deposits of this alloy resist oxidation up to 1800 degrees F. and are ductile. The shear strength of a joint is approximately 34,000 pounds per square inch. It is recommended for furnace brazing in either pure, dry hydrogen or in a vacuum atmosphere. It can also be used for torch brazing in air when used as a paste or with Nicrobraz flux. The recommended brazing temperature is 2150 degrees F.

Adhesive for Bonding a Variety of Laminating Materials

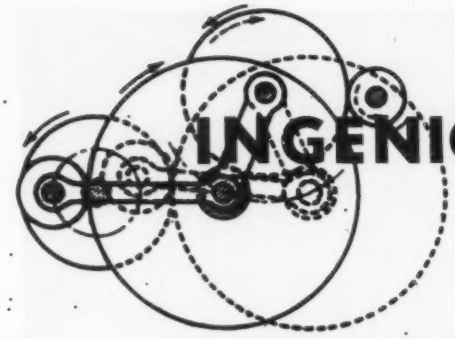
A versatile elastomeric-base adhesive that produces high-strength bonds between a variety of laminating materials without using heat or pressure has been made available by Adhesives, Coatings and Sealers Division, Minnesota Mining & Mfg. Co., 423 Piquette Ave., Detroit 2, Mich. Designated "EC-1368," this light-colored adhesive produces high-strength laminates of plastic, steel, aluminum, wood, and other materials. Bonds produced have a high dead-load shear strength, a high peel strength, good water resistance, and will retain strength and adhesion at temperatures over 200 degrees F.

The adhesive can be applied by brush, spray, or hand roller. It has been used to bond decorative plastic laminates to metal counter and table tops and also to bond plastic, steel, or aluminum facings to paper honeycomb cores in non-load-bearing sandwich panel construction.

Solder Made of Epoxy Resin and Aluminum Pigment

A solder made up of aluminum pigments combined with epoxy resins and sold under the name of "Poly Epoxyn Solder" has been introduced by Co-Polymer Chemicals, Inc., 12350 Merriman Road, Livonia, Mich. The putty-like solder is applied to a pre-cleaned and pre-heated metal area which is sanded and painted after curing. The treated area is said to withstand a blow hard enough to damage the surrounding untreated area. It has a tensile strength of 1400 pounds per square inch and resists the effects of quick changes of temperature. This solder can be used in many automobile applications where heat poses a problem. It can be used to repair holes, dents, tears, creases, and rusted-out areas.

The Gaines Co., Rivera, Calif., a light-metals foundry, cast this zirconium-thorium alloy casting in a permanent mold for the Boeing Airplane Co. A fine grain, good finish, and dimensional accuracy are obtained by using the permanent molding method in casting this alloy



INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Intermittent Drive with Reverse-Locking Feature

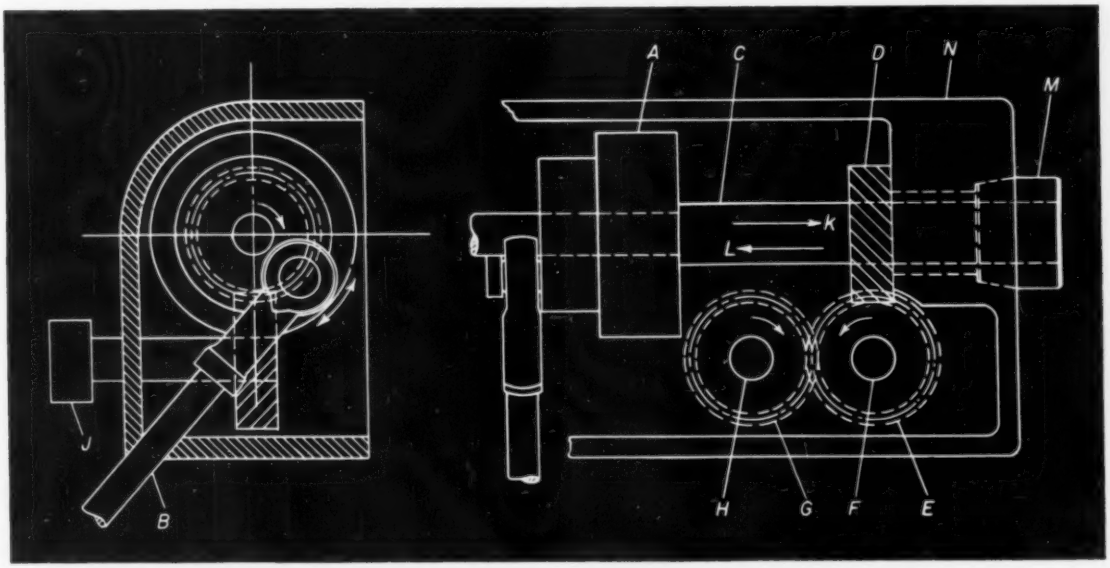
J. J. DECOULOS, Peabody, Mass.

An arrangement that prevents reversal of an intermittent drive during the dwell period is here illustrated. Compact and quiet in operation, the device was designed for use as a high-speed indexing mechanism in shoe processing machinery.

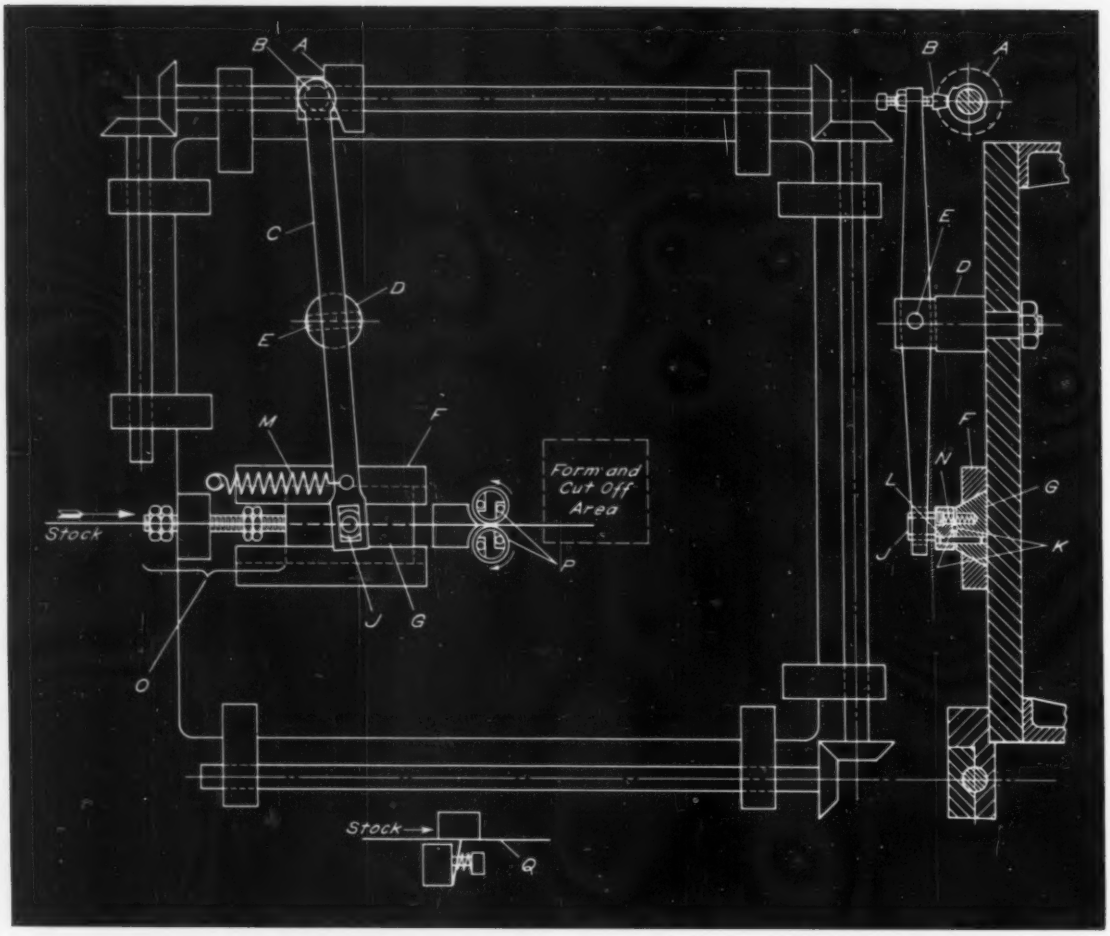
A roller type indexing clutch *A* is driven with a reciprocating motion by connecting-rod *B*. This causes shaft *C* to rotate clockwise intermittently. Right-hand helical gear *D* is fastened to shaft *C* and engages with a second right-hand helical gear *E* attached to shaft *F*. Left-hand helical gear *G* mounted on shaft *H* also meshes with gear *E*. Two feed rollers *J* are fastened to the ends of shafts *F* and *H*, which rotate intermittently in opposite directions.

When clutch *A* is driving gear *D*, a thrust is produced laterally in shaft *C* in the direction *K*. During the dwell portion of the indexing cycle, any attempt to make gears *G* and *E* the driving gears will produce a lateral thrust and displacement of shaft *C* in the opposite direction *L*.

A cone brake *M* attached to shaft *C* takes advantage of this reversal of thrust to lock the shaft and the rollers during the dwell period. Thrust in the reverse direction *L* causes the cone to be displaced slightly and become tightly held in a mating conical bore in frame *N*. An increase in the reverse thrust only increases the holding power of the cone brake. During the following index cycle, the thrust produced on shaft *C* by helical gear *D* is again in direction *K*, and cone *M* is released from the conical bore. Lateral movement of shaft *C* is held to the minimum displacement necessary to free the cone.



Cone brake prevents reversal of this intermittent drive during the dwell period.



Cam (A) controls the feed of the wire by having its motion translated to quill (G) through lever (C).

Combination Cam Controls Stock Feed of Wire-Forming Machine

KARL W. NITTEL, North Attleboro, Mass.

A combination end and radial cam is the heart of a stock feed for a multiple-slide wire-forming machine. The accompanying illustration shows the arrangement of the parts.

The combination cam *A* is carried by the machine's shaft system. It is basically a two-diameter plug, the shoulder having been modified to form an end cam, and the small diameter to form a radial cam. Follower *B* in lever *C* rides on both cam surfaces.

This lever fulcrums at its center on stud *D*. By being joined to the stud by cross-pin *E*, the lever can swing both left to right (to follow the end cam surface) and in and out (to follow the radial cam surface).

Directly behind the lower end of the lever is a dovetail slide *F* containing quill *G*. The quill has two parts. One part fits the dovetail, and the other has a pin carrying bushing *J* which fits a slot in the lower end of the lever. There is a semicircular section *K* in the mating surfaces of the two parts of the quill, through which the stock advances. (The section can be modified to accept whatever stock size or shape is used.) The outer part of the quill is held in position by loose-fitting pin *L*.

The drawing shows the lever position at a point in the feed stroke. At the start of the stroke, spring *M* pulls the bottom of the lever to the left. As the cam starts to rotate, the lobe on its small diameter bears against the follower, causing the bottom of the lever to swing in and thus force

the quill to close tightly over the wire. At the same time, the end cam forces the bottom of the lever to the right, thus advancing the wire.

When the lever reaches the end of the forward stroke, the follower no longer has any thrust on it from either cam surface. Spring *N*, contained in a hole extending into both parts of the quill, then allows the quill to release its grip on the wire. Next, spring *M* operates, pulling the lever to the left, and the feed cycle is completed.

Stop-block assembly *O* provides stroke-length adjustment by controlling the point to which the lever can return. A simple way to prevent the wire from tending to move back on the return stroke is to add a pair of non-reversing rolls *P*. Or, a spring check *Q* can be used.

Spring-Loaded Segment Gear Provides Pause in Gear Train

RALPH T. STEWART, Winston-Salem, N. C.

Holders for X-ray plates are raised and lowered through the medium of a gear train. Provision is made for a pause in the movement to permit removal of the photo-sensitive plate. On some units this hesitation is designed into the gear train in the illustrated manner.

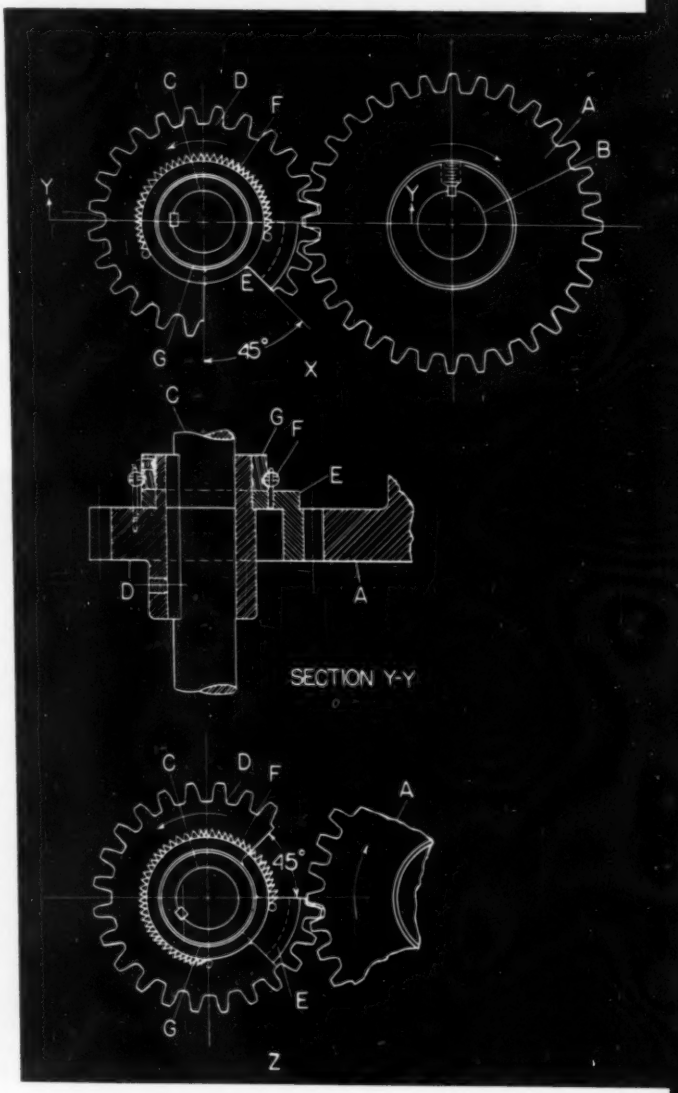
Gear *A* drives shaft *B* (View X) which, in turn, actuates the plate-holder (not shown). Rotation of this gear must be interrupted at regular intervals to provide a short dwell period. It is construction of the driving-gear member that causes the required intermittent motion to occur.

Keyed to driving shaft *C* is gear *D*. This gear, which meshes with driven gear *A*, has a 90-degree section removed which is equal to twice the angular distance necessary for the pause. Occupying half this area (45 degrees) is a segment gear *E* that pivots around the hub of gear *D* (Section Y-Y). One end of a long coil spring *F* is pinned to driving gear *D*—the opposite end being pinned to segment gear *E*. The spring normally holds the segment gear in the position shown in View X.

The gears in View X are in position for the beginning of the dwell period of driven gear *A*. As the last tooth of gear *D* leaves gear *A*, the first tooth of segment gear *E* comes into mesh.

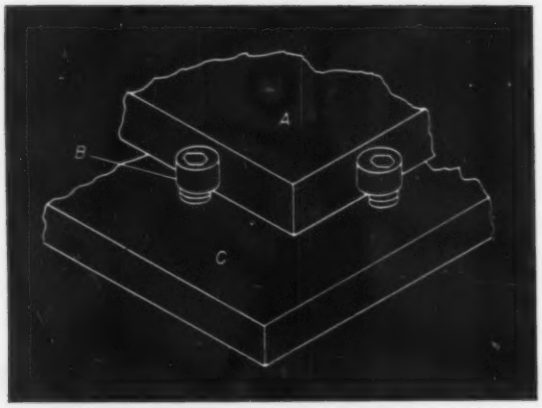
Although gear *D* moves continually, the segment gear, being freely mounted, does not transmit any driving motion. It remains stationary, as does gear *A*. The dwell continues for a 45-degree rotation of gear *D*. At this time (View Z) the opposite end of the cutout in the driving gear contacts the segment gear and pushes it as a solid unit, once again turning gear *A*.

When the segment gear *E* has cleared gear *A*, it is returned to its original position by spring *F*. The unit is then ready for the next cycle of operation. It can be seen that this design prevents clashing of the gears such as would occur if simple cut-away gearing were used. The mechanism can be designed for almost any dwell period, providing the sides of the cutout and the sides of the segment gear bisect a tooth space.



Gear train permits gear (A) to dwell for a distance of 45 degrees out of every 360-degree rotation of gear (D). Smooth engagement and disengagement of the two gears are made possible by action of segment gear (E).

SHOP KINKS



Jig clamps that are made from socket-head cap-screws

Easily Made Jig Clamps

ERNEST JONES, New York City

Simple clamps for use in jigs and fixtures are easily made from socket-head cap-screws. This is accomplished by machining the heads of the screws eccentric to the shank. The illustration shows how a work-piece *A* can be held by two of these clamps *B*.

Carefully located tapped holes in the jig plate *C* are necessary to properly use the eccentric-headed screws as clamps. Rotating the screws with a socket wrench clamps the part against the locating surfaces of the jig or fixture. When worn, the screws are easily replaced. For long-run production, however, a hardened bushing may be pressed over the screw-head to provide a wear surface.

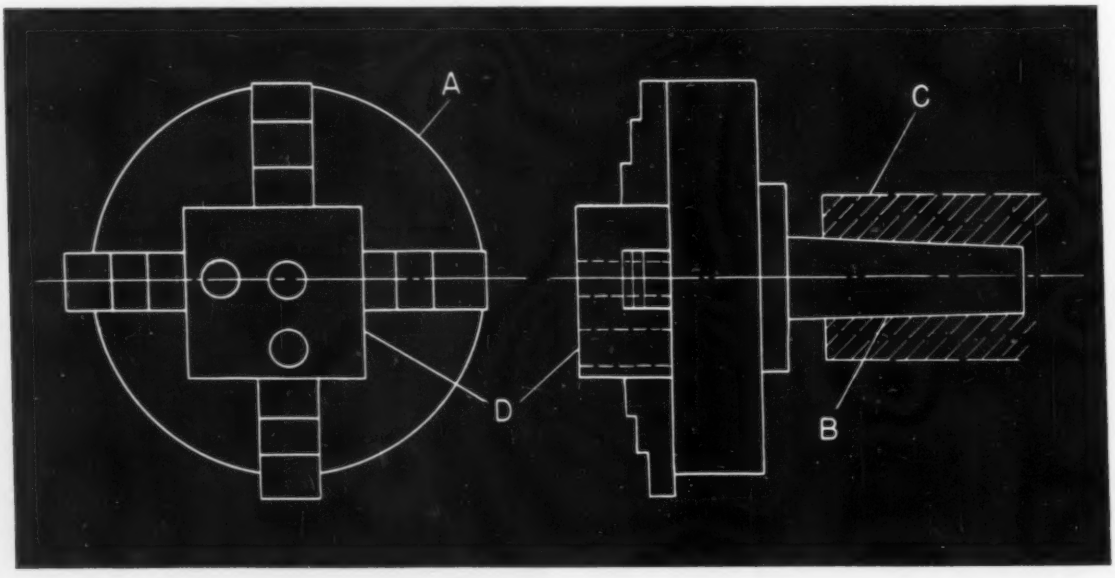
Chuck Adapted for Lathe Tailstock

FRANK L. RUSH, Woodbourne, N. Y.

When a drill press is not available and the work-piece is too large and irregular to be swung in a lathe by conventional means, drilled or reamed holes may be produced in the manner here illustrated.

A four-jaw chuck *A* is attached to a shank *B*, which fits into the tailstock spindle *C* of the lathe. The cutting tool is held in the spindle of the headstock, and the work *D* is drilled or reamed as it is advanced by means of the tailstock handwheel.

This method of machining the holes is especially useful when they are located near the edge of the work or where it would not swing without striking the bed of the lathe.



Four-jaw chuck that is adapted for use in the lathe tailstock

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Novel Method for Producing Small Pins

CLINT MCLAUGHLIN, Rockaway, N. Y.

A device that can be used in a bench lathe to manufacture small, chamfered pins at a rapid rate is here illustrated. The unusual feature of this arrangement is that the tools rotate instead of the stock.

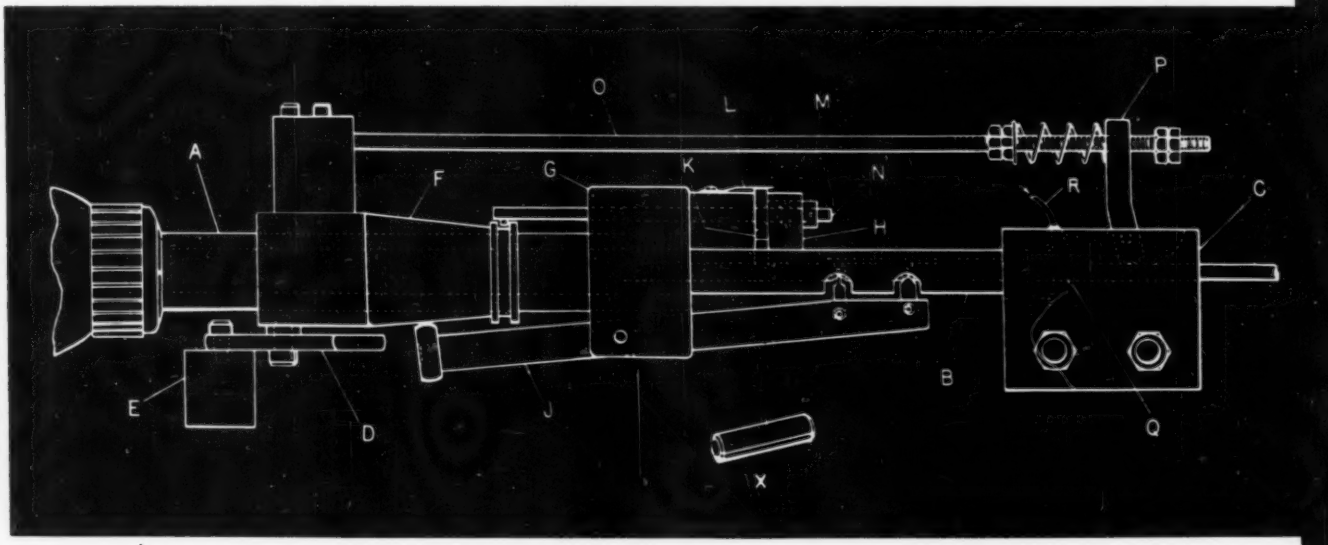
In construction, the device incorporates a tube *A* which is gripped by a collet or chuck in a small lathe. A tube *B* is made to press fit in tube *A*. The right-hand end of tube *B* rotates in a bushing in a block *C* bolted to the lathe compound. Handle *D*, positioned approximately vertical, pivots on a pin in a block *E* clamped to the lathe bed. This handle swings left and right, and pushes a sleeve *F* horizontally along tube *A* by means of a shouldered screw secured in the sleeve. This screw is retained and slides in a through slot in the handle.

Part *G* (a collar pressed on tube *A*) carries a projecting block *H* which is turned on the left-hand end for a press fit in a counterbored hole in the collar. In addition, collar *G* is slotted to accept an arm *J* that is pivoted on a dowel mounted across the slot. This arm supports a roller on the left-hand end and two tools are carried in slots in the right-hand end. The roller rides on sleeve *F* which controls the infeed motion of the tools. A V-notch is cut by the right-hand tool, and the second tool parts the stock at the previously machined notch. A completed pin is seen at X.

The stock-stop mechanism consists of a stop-plate *K* that slides in a slot in block *H*. Stop *K* is retained by a rod *N* and carries a pin which enters the tube to stop the work-piece. Spring *L* holds the stop-pin in the tube. Collar *M* is chamfered on the left-hand end to provide a means of retracting the stop. On the back of sleeve *F* is a rod *O* which operates stock clamp *P*.

In operation, the stock which does not rotate is manually fed in at the right, passing through block *C* and a neoprene ring *Q*, and coming to

Plan view of device that is used for rapid production of small chamfered pins on a bench lathe.



rest against stop *K*. Ring *Q* prevents the coolant from flowing back along the stock. Tubes *A*, *B*, and associated parts *G*, *H*, *J*, *K*, *L*, *M*, and *N* rotate with the lathe spindle. Then, handle *D* is pushed to the right, moving sleeve *F* to the right. This causes the roller on arm *J* to ride up on the taper and thus feed the tools into the work. The action of clamp *P* prevents the work from rotating as the tools simultaneously cut off one pin and chamfer the next.

Coolant flows through tubing *R* into block *C* and along a keyway in tube *B*, lubricating the bushing in which tube *B* rotates and flushing chips away from the two tools. The tool area is covered to prevent coolant from being thrown outward at the operator. This cover is not shown.

On completion of the cuts, handle *D* strikes a stop (not shown). Then, as the handle is returned to the left, the tools are retracted automatically by centrifugal force, and clamp *P* is released. Further movement of the handle to the left causes the tapered end of collar *M* to enter a hole in stop *K* and retract the stop. When the stock is again fed toward the headstock, the finished piece is pushed to the left along the inside of the tube. Then, by pulling the stock back slightly, and moving the handle a short distance to the right, the stop is allowed to re-enter the tube. After pushing the stock against the stop, the work cycle is repeated. Finished pieces fall out at the rear of the lathe spindle into a collecting pan.

Die Has Floating Horn to Allow "Closing" of Flat Stock

BUCKLEY SULLIVAN, Shaker Heights, Ohio

Work-pieces, originally made from strip stock in three separate operations, can be formed with one stroke of the press ram by the unique die here illustrated. Previous operations, requiring three dies, included shearing to length, curling of ends, and bending of center.

The part shown at X in Fig. 1 is made from 0.060-inch thick hot-rolled steel that is first sheared to 1 1/4 inches in width and then fed through the die in 4- to 12-foot lengths. In Fig. 1, the die is illustrated in the open position with the stock in place. The lower member consists of two blocks *A*, with reversible and hardened members *B* at the bending corners; a reversible, hardened insert *C* at the shearing edge; and a stock stop *D*. A hardened bumper block *E* is located at the bottom of the die opening.

The upper half of the die supports the shearing leg *F* which has a hardened and reversible shearing insert *G* at the bottom. Closing block *H* is located at the top of the die above horn *J* which slides vertically in gibs *K*. Parts *H* and *K* are both hardened. Heavy springs *L* force the horn down against plate *M* at the bottom of the

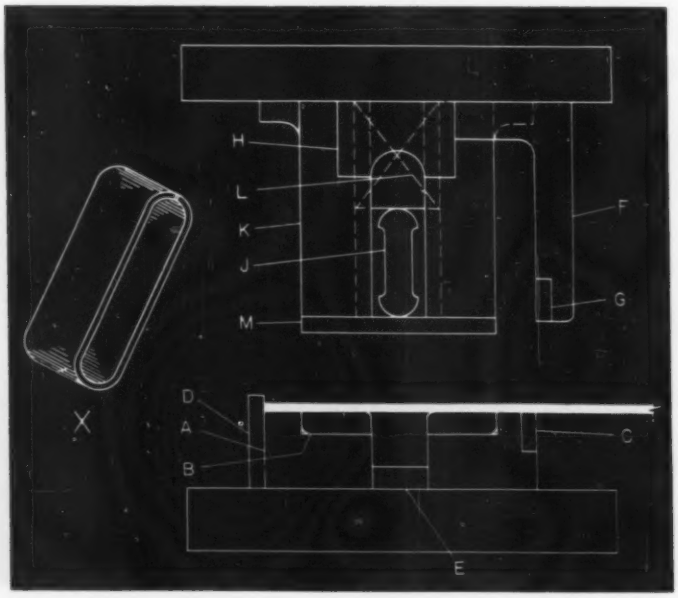


Fig. 1. Work-piece, seen enlarged at (X), is fabricated from strip stock in one operation with the die shown. Horn (J) is in the fully extended position.

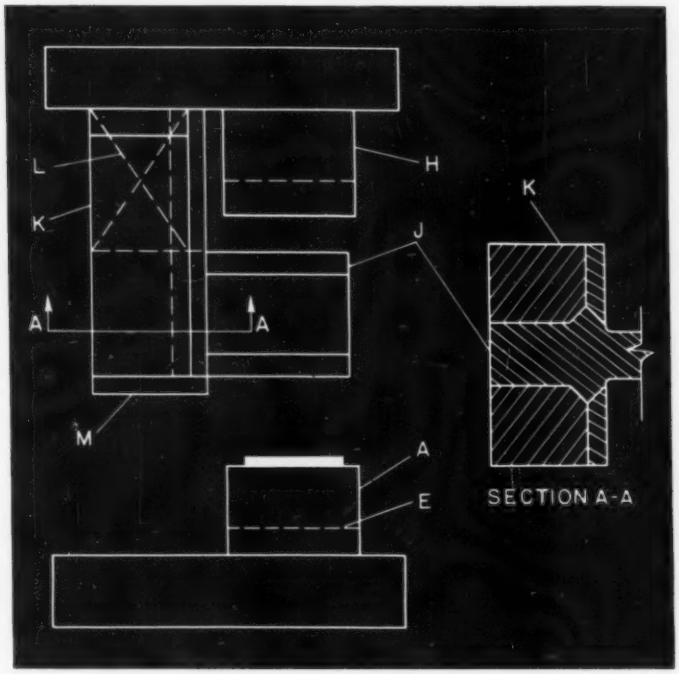


Fig. 2. (Left) Relative positions of closing block (H), horn (J), and die-blocks (A) are more clearly shown in side view of the die. The horn slides within the gibs (K) (Section A-A).

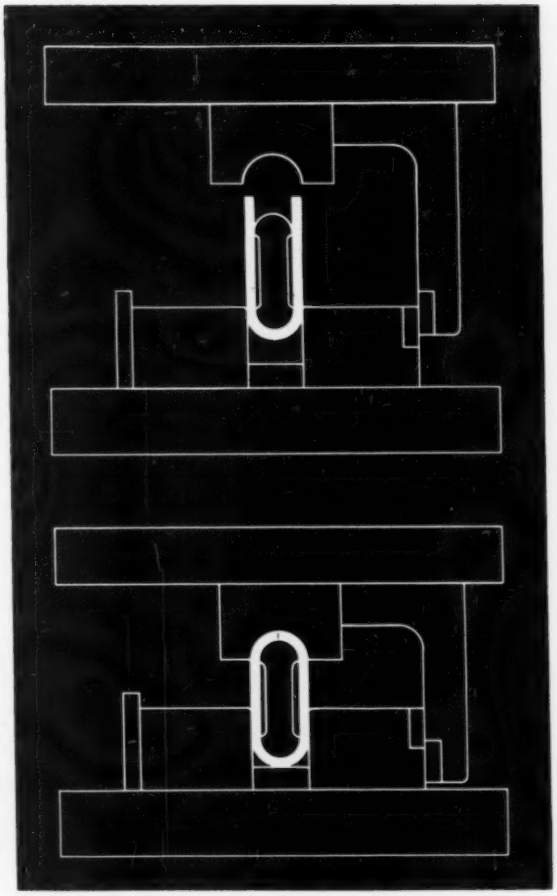
Fig. 3. (Below) With the ram partially descended as seen at the top, the stock has been sheared and the center portion bent. In the lower view, the ends are "closed" to complete the piece.

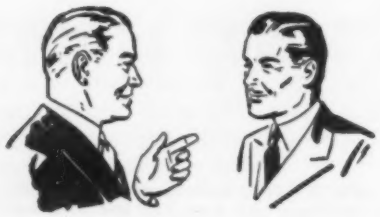
guides. The gib construction and arrangement for locating and holding the horn are illustrated in Fig. 2.

In operation, the stock is placed in the die and positioned against the stop. The press is then tripped, and as the ram descends, the stock is first sheared to length. Since the shear blade projects only 1/16 inch below the bottom of the horn, there is insufficient time for the stock to move out of place.

The momentum of the ram and the heavy springs acting against the horn serve to bend the blank into a U-shape, as shown at the top in Fig. 3. Continuing to descend, the horn forces the work-piece into the die opening until it strikes the bumper block *E*. Here the work-piece and horn stop, while the ram, in finishing its stroke, forces the closing block *H* against the blank to complete the operation. At the bottom in Fig. 3, the die is shown in the closed position. Due to spring-back, the finished part is readily removed from the horn either by hand or by mechanical knockouts.

The entire die is made of cold-rolled steel except for the horn, closing block, and the hardened bending and shearing inserts. By making these inserts reversible, the die need not be removed from the press to renew the edges. The gibs are covered with hard-bronze alloy wear plates (not indicated) and kept well lubricated. This die has successfully produced thousands of parts with minimum down time.





Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Use Props as Tools to Create Inquiries

THIS YEAR, selling has been undergoing healthy self-criticism. "Everyone seems to be looking to the other fellow to do the selling," says the president of National Sales Executives, Inc. "The salesman doesn't chase the prospect anymore—the prospect chases him," exclaims an automobile sales manager. Another executive deplores the necessity of offering salesmen de luxe trips to Paris or Havana as an enticement to do their best jobs.

In many quarters, hard selling has been in retreat in the face of the growing tendency to split selling into parts and distribute its responsibilities. Advertising, demonstrating, packaging, and repair service—each has its separate role, particularly in the field of merchandise sold for personal use. The prospect now is urged to come, look, and choose. Yet the engineer who sells to industry still must search out the prospect in his office or plant.

There is a loud cry for "creative selling," but the meaning is seldom made clear. The merchandise salesman is creative when he "sells hard" or fights for orders that are hard to get. To the sales engineer, creative selling suggests a great deal beyond this. It indicates uncovering a hidden need, defining a way to satisfy it, and giving the solution direct appeal.

But we don't merely snap our fingers to bring about creativeness in sales engineering. It is done by re-adjusting our bearings and lifting our sights. It is done by putting imagination to work full time on a set of fresh ideas.

Contrary to the common notion in consumer quick-sale merchandising, a dollar's business from one customer differs in value from another. Selling equipment to a young, dynamic customer is worth lots more than selling to one who is drifting. If the sales attack has been selective, the order itself might very well create others.

Think in terms of the customer's product and market. Then work back through his manufacturing processes. Here is where the sales engineer's alertness to modern technology pays off. You can't fail to find a foothold for creating an inquiry if you bring to light the chance for an investment which can lower the cost of a product or improve its quality.

Don't fail to present the essential idea that the time for improvement is when business is slack. It is then that savings are urgent, and time and talent for planning and re-arrangement are more readily available.

Get the full impact of the customer's changed interests and needs. Most new plants have been built to yield low cost through volume, yet lowering production costs still remains a ticklish problem for many plant managers.

Tailor the whole suit of clothes—not just the coat collar. When business is lush because of the pressure of many inquiries, we so often sell only a "piece" of a job so as to get quickly on our way. It is better to create a more inclusive and valuable installation which has a definite character and which itself will be the source of other business.

Discover what it means to lift your competitive position by doing a creative selling job. Fresh ideas in concert with well-designed and well-engineered equipment compel customer attention. The man who swaps equipment for dollars is easily forgotten, but not the man who leads the way to new profits. "Do you recall so-and-so?," we asked a plant executive, referring to a sales engineer. "Guess I've forgotten him by now. What did he do for us?"

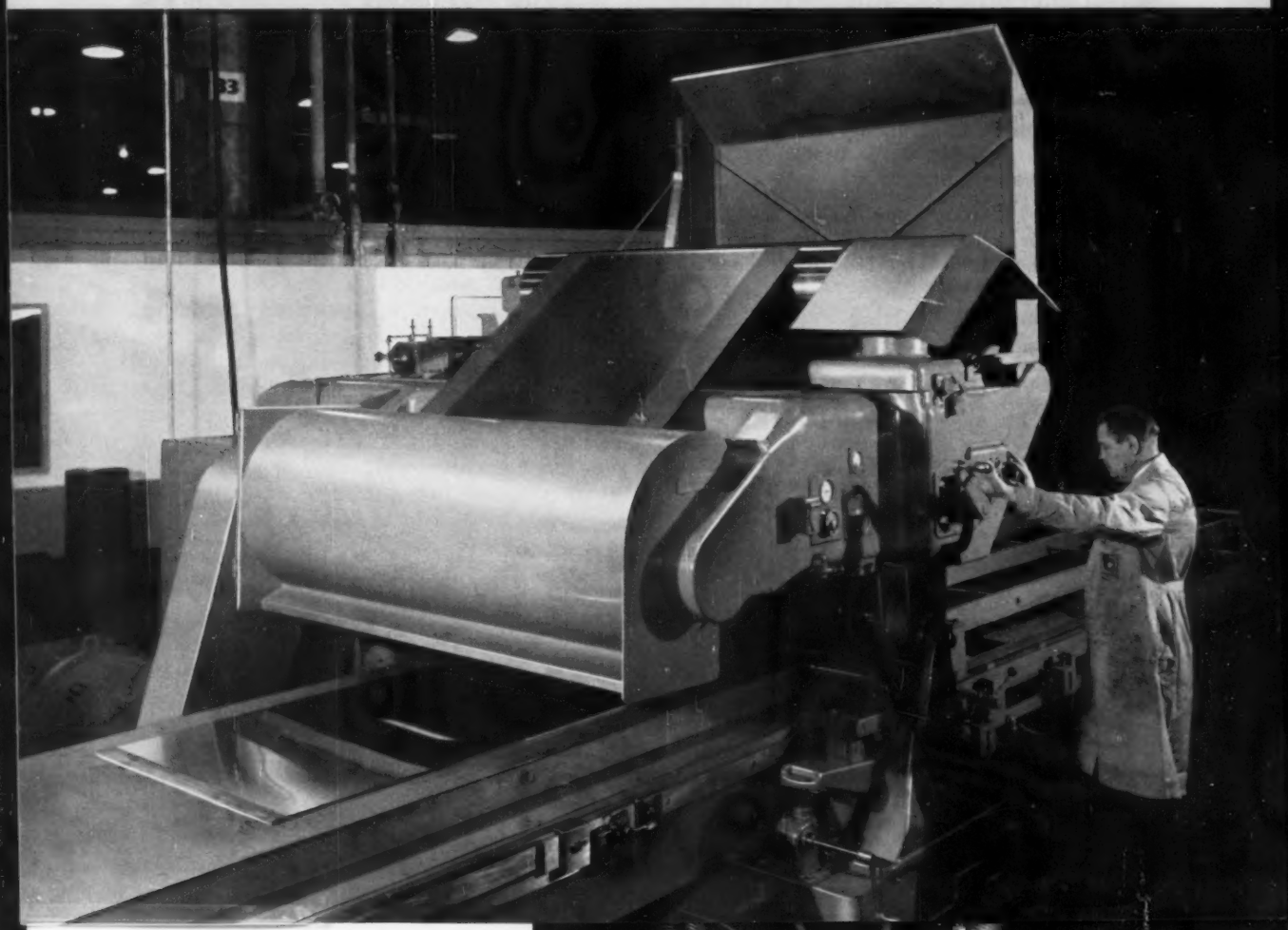
Since selling has been split into parts, the salesman has more props to lean on than formerly. But these props are not only supports; they are tools to make inquiries. We have various systems to pay salesmen for booking orders, but not for creating inquiries. You don't measure creative selling on a slide rule. The ability to change sales props into sales tools, and to reward those who create inquiries, represents sales supervision at its best.

AUTOMATIC GRINDING WITH COATED ABRASIVES

. . . finds widespread use for roughing, finishing, and polishing

Uniform finishes on work adapted to conveyorized surface grinding can be produced rapidly and consistently. A minimum amount of labor is needed, resulting in a comparatively low cost per piece. Although still in its infancy, automatic grinding with coated abrasives would seem to be the answer to many of industry's high-cost finishing problems.

J. KARL McLAUGHLIN, Product Engineer
Behr-Manning Co., A Division of Norton Co.
Troy, N. Y.



AUTOMATIC GRINDING WITH COATED ABRASIVES

. . . finds widespread use for roughing, finishing, and polishing

J. KARL McLAUGHLIN, Product Engineer
Behr-Manning Co., A Division of Norton Co.
Troy, N. Y.

THE BASIC PRINCIPLE of bringing the work to the abrasive element by either automatic or semi-automatic means is being applied to high-production grinding and polishing operations in numerous ways. Historically, the development of improved abrasive materials has been matched by improved systems of work handling and work movement. It follows, as a logical consequence, that the abrasive process has been incorporated into the production line.

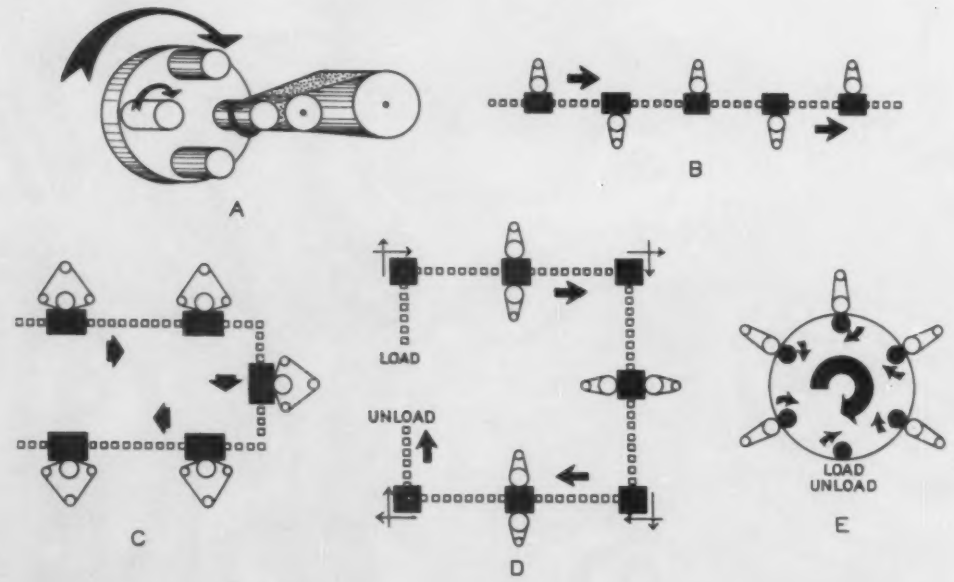
Methods of work handling and the type and placement of abrasive heads to afford full coverage of designated surfaces fall into a number of patterns. Several of the more conventional systems are illustrated diagrammatically in Fig. 1. In the unit at *A*, the work-pieces are mounted on a vertical rotary plate. This plate indexes, presenting one part at a time to the moving abrasive-coated belt. Rotational movement is also imparted to each of the work-pieces to assure uniform metal removal.

Transfer equipment, utilizing linear travel for continuous-flow operation, is designed to blend with individual plant layout and existing production situations. In these systems the parts are usually group-mounted in fixtures that are pulled past fixed polishing heads. One of the most common installations is the straight-line setup illustrated at *B* in Fig. 1. Here, parts are moved into successive engagement with a line of coated-abrasive heads.

It is frequently the case that the work-pieces being finished must be returned to their starting area. In this system, once again, the parts are pulled past fixed polishing heads. Details of the flow pattern vary somewhat, depending on the design of the machine.

Some installations make use of a U-shaped line on which the work-holding fixtures are advanced by a chain conveyor. The fixtures progress from the outward-moving line to the return line around a smoothly curved path at the far end of the "U". Abrasive heads are frequently positioned, angled, or contoured to provide adequate work coverage.

Fig. 1. Installations for automatic or semi-automatic coated-abrasive grinding may conform to one of the several layouts illustrated, depending on individual production requirements. The straight-line setup (B) is one of the most commonly used.



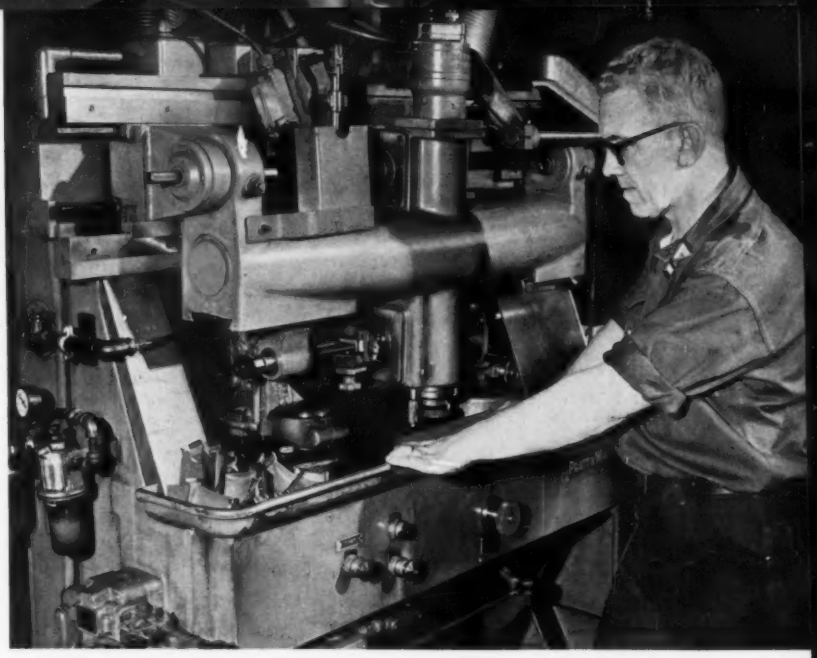


Fig. 2. Turbine rotor blade is being shaped by an abrasive-coated belt on this profile-grinding machine. Three cams control its operation—a master cam, lower right-hand quadrant; a wave cam, upper right-hand quadrant; and a velocity cam, upper left-hand quadrant.

A polishing head is located at the return end of the transfer system illustrated at *C*. At the end of their travel down the first side of the line, the work-pieces are swung mechanically into alignment with the end head. On reaching the next corner they are again pivoted, then start their return along the second side of the line.

Loading and unloading by one operator is possible with the layout shown at *D* in Fig. 1. The polishing heads are arranged in opposed pairs along three sides of the rectangular transfer line to permit finishing two faces of the parts simultaneously. As they pass each station, the parts are turned so that all surfaces are exposed to the same abrasive treatment, resulting in a uniform overall finish.

A highly developed coated-abrasive grinding procedure is found in the rotary machine at *E*. It occupies a minimum of floor space and allows a single operator to handle both loading and unloading without moving from his station. Work-pieces are mounted on spindles located around the edge of a rotary table. This table advances the spindles past the polishing heads with either a continuous or indexing movement. Depending on job requirements, the parts may be rotated while in contact with the abrasive medium.

Work Feed Controlled by Cams

Cams are commonly used to provide the controlled movement by which the work-pieces are fed up to, and away from, the grinding or polishing head. The cam can be driven by compressed air, hydraulic fluid, or mechanical linkage.

In a pneumatic system, motion is imparted by the action of compressed air on a piston. Timing of work advance and withdrawal is controlled by solenoid valves actuated by either cam trips or a timing disc. When hydraulic pressure is used, the work-support is moved by either a piston or a hydraulic motor. Timing may be governed by solenoid valves or cam controls. If neither hydraulic nor pneumatic systems are used, motion may be imparted to the work-support by mechanical linkage that is actuated and controlled by either cams or electric motors.

Three basic types of cams are in general use on automatic and semi-automatic machines: face cams, cylindrical cams, and plate cams. Plate cams are often used to control fixture motion on automatic machines and to advance and retract polishing heads. These cams are also used frequently to trip valves and solenoid switches.

Abrasives Play a Major Role in Shaping Jet-Engine Blades

Compressor blades, stator blades, nozzle diaphragms, and turbine buckets of modern aircraft engines are made by three processes: rough forging followed by machining all over; precision forging; and precision casting. All of these methods require subsequent finishing with coated abrasives.

Rough forged blades—When blades start off as rough forgings, they must be completely machined to attain their final contours. One method of accurately shaping the airfoil form on turbine blades makes use of a Pratt & Whitney profile-grinding machine, Fig. 2. A 5/8-inch wide, 90-inch long cloth belt of 50-grit aluminum oxide (resin bonded) is run at a speed of 7200 sfm (surface feet per minute). Grinding oil is used as a lubricant.

Forged blanks with 0.060 to 0.090 inch of stock

to be removed are gripped, one at a time, by an adapter in the lower left-hand quadrant of the machine. The abrasive-coated belt passes over a small contact wheel and grinds the blade profile area to final size.

Three cams control the grinding operation. The master cam (lower right-hand quadrant) rotates with the blade and causes the work-frame to pivot in and out. A wave cam (upper right-hand quadrant) imparts a swiveling motion to the abrasive-belt fixture. A velocity cam (upper left-hand quadrant) varies the rotary speed of the work-piece to permit the leading and trailing edges, which are comparatively thin, to pass the abrasive belt at a faster rate than the broader surfaces.

Materials used for turbine buckets are especially difficult to machine and are subject to work hardening. The coated-abrasive method is used to produce these parts economically, holding them within the required 0.003-inch tolerance.

Precision forged blades—Several steps are required to shape blades by the precision forging process. It is the case with many blades, especially during initial breakdown operations on turbine buckets, that frequent reheating of the blanks is required. Between forging heats, the work-pieces are descaled and inspected visually for cracks, seams, folds, or any other surface defects.

Even the slightest surface defects must be removed before further forging to prevent them from being pounded deeper into the blade. To do this, resin-bonded, 80-grit aluminum-oxide cloth belts are generally used. The belts are backed up by small-diameter contact wheels and the parts are held against them by hand.

Correct radius of both the leading and trailing edges can be formed on the blade by a free hand method using a contact wheel. In some cases, a fully automatic machine—which uses a free belt over which the blade is wiped to give the desired radius and contour—can be used. With unskilled labor, machines of this type can handle as many as 700 pieces per hour. The necessary high finish for these parts can be obtained by selecting the correct grit (approximately 180).

The over-all high finish which, on jet-engine compressor blades is 16 micro-inches or less, is produced by means of longitudinal polishing on automatic, rotary type machines. In the particular application shown in Fig. 3, a six-station Hammond automatic blade polisher is being used. The work-holding spindles project from a central indexing turret. It should be noted that this operation is not intended for corrective grinding.

A roller chain beneath the table drives a modified Scotch yoke which, in turn, drives the spindle ram. The ram has three motions—reciprocation, oscillation, and rotation. Reciprocation is a function of the Scotch yoke mechanism; oscillation is obtained by pivoting the ram at its front bearing block. This moves the ram approximately 1/32 inch either side of the center line to help break up polishing marks left by the abrasive grains.

Work-heads are located at five stations, the sixth station being reserved for manual loading and unloading. At each work-head the blades are reciprocated between two formed-rubber contour pads over which pass aluminum-oxide abrasive strips. The cloth strips are automatically advanced between strokes to present a fresh cutting surface. As the ram is free to turn on its long axis, a twisting motion is imparted when the blade passes through the contour pads.

Each blade engages the five work-heads during

Fig. 3. Airfoil surfaces are being finished on this six-station rotary machine by pairs of abrasive strips. As they index from station to station, the blades progress from 80-grit belts at the start to 220-grit belts at the finish.

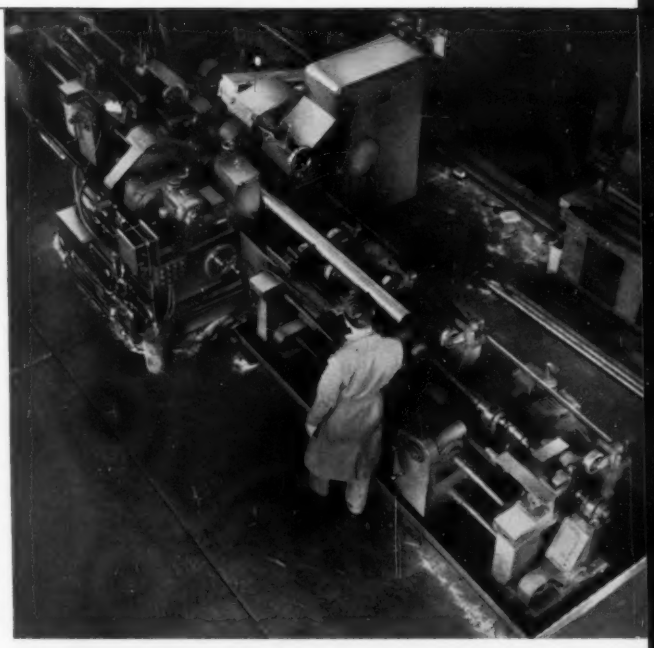


Fig. 4. A length of steel tubing having an outside diameter of 6 inches is shown being finished on a centerless abrasive-belt grinding machine. Direction of work travel may be reversed by tilting the regulating belt mechanism and the power-driven fixtures.

a complete finishing cycle—progressing from an 80-grit belt at the first station, through 120-, 150-, and 180-grit belts at the second, third, and fourth stations, ending with a 220-grit belt at the last station. A light oil is used at the point of contact.

A high finish is produced through a crushing and burnishing action. It is similar to that used to produce high finishes on automotive crankshafts. One operator can produce 400 to 500 finished blades per hour.

The last operation must give the longitudinal lines necessary to prevent the development of fatigue cracks when the part is operating in the jet engine. Longitudinal polishing—a relatively inexpensive process—is coming into widespread use prior to the final forging, or coining, operation to clean up the blade surfaces.

Precision cast blades—Although alloy-steel parts are produced to close dimensions, precision casting leaves an undesirable skin approximately 0.005 inch deep which must be removed. Abrasive-coated belts used with contact wheels remove this casting skin and yield the desired finish. Precision casting techniques are generally applied only to those parts that are stationary in the engine. Required surface conditions are usually obtained by a two-step method using an 80-grit belt for a roughing operation, followed by either a 120- or 150-grit belt for a finishing operation.

For Production Economy, Special Machinery

Manufacturers of jet blades strive to build automatic machines which do not demand skilled labor to produce the complex parts. It follows that many special machines, most being either automatic or semi-automatic, have been developed by individual production concerns. One which might be mentioned was adapted from a rise-and-fall type milling machine. It uses an abrasive-coated belt to bring the blade to the required dimensions and finish in the fillet and platform areas. This particular machine usually processes only one side of the blade at a time, thereby requiring an accompanying machine for the second side.

There are also special automatic fillet-polishing machines which use a cam to rotate the blade through the desired path. While rotating, the work-piece is held against a fixed contact wheel over which an abrasive-coated belt is fed. Inasmuch as many of the rejects in blade manufacturing are the result of undercutting at the trailing edge, a cam-controlled machine can be an asset.

Some manufacturers have built their own special machines for producing longitudinal lines in the fillet and platform area without the use of a contact wheel. Instead, the abrasive-coated belt is forced against the work by a compressed-air jet to perform the polishing operation. Prior to this step, the desired profile or shape can be ground in the fillet and platform area using a formed wheel; the air-jet machine simply changes the direction of the grit lines at the critical stress point of the jet blade.

Machines have been developed, and are being used, which employ an abrasive-coated belt running over a stationary, formed-steel nose-piece. Desired radii at the leading edge, trailing edge, and fillet of the blade are produced by accurate, cam-controlled indexing of the part.

Titanium Alloys Present a Problem

Metals used in jet-engine parts are comparatively difficult to grind. This is particularly true of titanium alloys. Also, these alloys are easily heat-checked, a condition which may not show up until a blade receives its final inspection before shipment. Momentary temperatures at the grinding point may approach 1200 to 1500 degrees F., at which heat the titanium has an affinity for abrasive grain. Abrasive belts run at slow speeds with the proper coolant will insure success in this particular operation.

Selection of the abrasive grit to be used on titanium varies among manufacturers. Both aluminum oxide and silicon carbide are used, depending on the application. Offhand grinding of

Fig. 5. Contact area of the grinding machine shown in Fig. 4. The regulator is an abrasive belt (left-hand head) rather than a wheel. Tilting the regulating head controls the direction and rate of work feed.

titanium, or spotting out of defects, is usually performed with silicon carbide. However, in some machines, such as the Pratt & Whitney profile-grinding machine (Fig. 2), aluminum oxide is required, since it withstands the higher pressures encountered and because hard contact wheels are used. Application of a lubricant, preferably a grinding oil, helps to prolong belt life.

Abrasive Belts are Employed for Centerless Grinding Operations

Principles of centerless grinding, as applied to machines using abrasive belts, are much the same as those for machines using conventional grinding wheels. Minor variations are found in the angles of the work-rest and regulating wheel (or belt), but the remaining factors are alike.

The successful use of abrasive belts for centerless grinding is largely due to the advent of resin bonds and superior belt joints. One of the new cutting oils containing percentages of chlorine and sulphur should be used. These oils may be naphtha, paraffin, or mineral based. Their development has made it possible to operate machines at high pressures, speeds, and feeds—giving tolerances, finishes, and stock-removal rates comparable with those achieved by standard methods. When working with stainless-steel alloys, stock-removal rates are considerably higher than those obtained with hard wheels.

Several companies produce centerless abrasive-belt grinding machinery. Naturally, the choice of machine will be determined by the work to be done. Finishing of a 6-inch diameter steel tube on the Production Machine Co. unit shown in Fig. 4 is a typical application of the centerless abrasive-belt grinding process.

When stock removal is the primary consideration, a steel contact wheel should generally be used with a 40- or 50-grit belt. The coolant selected will determine the type of bond necessary. With oil, a resin bond will give excellent performance, whereas water will require a belt having a waterproof backing and coating.

Through-feed rates are dependent on the material, diameter, and depth of cut. The more stock removed per pass, the slower the feed. The illustrated machine will handle bar stock and tubing up to 6 inches in diameter and in almost any length, since the supporting fixtures on each side of the grinding head can be built to suit. When

Fig. 6. Flat-finishing machine having a two-roll work-head is designed for wet abrasive-belt grinding, polishing, and deburring. Continuous feeding of work up to 12 inches wide and 6 inches high is accomplished by a variable-speed, air-tensioned endless conveyor.

a regulating belt running over a steel platen is used in place of a regulating wheel (left-hand head in Fig. 5), it is possible to tilt the regulating head in either direction automatically. This permits reversal of the direction of feed and allows any number of passes to be made without removing the work from the machine. In one instance, using the illustrated machine, 0.010 to 0.011 inch of metal was removed per pass at a feed rate of 4.5 to 6.5 fpm (feet per minute) on 1.5-inch diameter, thick-wall tubing.

Another advantage of an abrasive regulating belt is the fact that feed rates can be varied simply by changing the head angle while maintaining line contact between work-piece and regulating belt. This is particularly important where heavy bar stock is involved. Should the regulator be a wheel, changing the angle would necessitate redressing the wheel in order to maintain line contact. If this is not done, there may not be enough friction to rotate the piece properly, or to feed it when heavy cuts are being taken.

Abrasive belts have the advantage of being quickly interchangeable. Selection of the proper abrasive belt will be governed by the work-piece: proper grit sequence can provide heavy stock removal while yielding a highly finished, accurate piece. Where a high finish with light stock removal is the primary requirement, finer grit belts ranging from 120 to 400 are used.

Aluminum oxide and silicon carbide are applied to both cloth and paper backings, using both glue and resin, in nearly all grit sizes. The aluminum oxide is generally used on steels, whereas silicon carbide is used largely on non-ferrous metals, wood, and plastics. Type and grit of the abrasive, and speeds of the belt to be used on any production setup are based on experimentation and previous experience.

Contact wheels can be had in various materials and surface conditions, and with different types of construction. Selection of the appropriate wheel, when used with a proper lubricant, is a prime factor in achieving the desired results. For centerless work the wheels are usually made of steel. Surface conditions can vary: a knurled face for heavy stock removal; a rubber face, either smooth or serrated and in a number of durometer hardnesses, to accommodate operations for either stock removal, surface finishing, or a combination of both.

Nearly all centerless machines are equipped for wet grinding. A filter system is invaluable for removing swarf and providing clean lubricant. Not only does the lubricant cool the work, but it also washes away swarf and helps to prevent belt loading, thereby extending belt life, improving work-piece finish and accuracy, and reducing horsepower requirements.

Success or failure of any centerless-grinding operation may depend upon the work-rest, or blade. It must have a smooth supporting surface and be sufficiently heavy to support the work. It should be parallel with the machine, both vertically and horizontally. Blade angle ranges from 20 to 30 degrees from the horizontal.

Height and distance from the contact wheel are critical. Whereas most grinding is done slightly above center to achieve roundness, too much height will produce chatter which, in severe cases, will cause the work to jump out of the machine. Long, heavy bar stock may require below-center grinding in order to hold the work on the blade, because of the tendency of the work to whip.

Fig. 7. Over-and-under surface grinder finishes both sides of a work-piece in one continuous pass. One side is ground by the upper head (left). The parts are then inverted and conveyed to the lower head (right) where the second side is ground.

The height is generally set so that the center line of the work is above the center line of the contact wheel by 0.0005 to 0.015 inch. In any case, this distance is seldom more than 0.125 inch, even on large-diameter work. Blades may be made of cast iron, hard steel alloys, or cemented carbides. For polishing operations the blades are often made of nylon, various plastics, and soft non-ferrous materials.

Continuous-Feed Surface Grinding

One of the major contributions to the mechanization of grinding and polishing was the introduction of the continuous-feeding surface grinder such as the Hammond flat finisher seen in Fig. 6. This type of machine will provide a uniform finish on parallel sides of various materials—ferrous and non-ferrous metals as well as plastics and stone. Although this equipment was originally intended for finishing work only, advances in abrasive belts have permitted them to handle stock-removal jobs efficiently. Most of these machines can be operated either with a lubricant, or dry.

The basic machine utilizes either a two- or three-roll arrangement to carry the abrasive belt, and is made to accommodate work up to 12 inches wide. In the two-roll system, a contact roll and an idler roll are used. The contact roll is usually the driven member, while the necessary tracking and tensioning controls work through the idler roll.

The head of the illustrated machine (Fig. 6) is of a two-roll design using an abrasive belt measuring 12 inches wide and 126 inches long. It consists of a large-diameter, air-tensioned, tracking idler pulley; a heavy dovetail slide for work-height adjustment; and a contact roll driven by a motor rated at up to 25 hp.

Some machines using the three-roll system have facilities for driving the abrasive belt with a roll either mounted directly on the motor shaft or driven from the motor by V-belts. This is the belt-

Table 1. Selection and Application of Contact Wheels

Surface	Material	Hardness and Density	Purposes	Wheel Action	Comments
Cog-tooth	Rubber	70 to 90 durometer	Roughing	Fast cutting, allows long belt life.	For cutting down projections such as weld beads, gates, risers, and sprues.
Standard serrated	Rubber	40 to 50 durometer, medium density	Roughing	Removes stock but leaves rough- to medium-ground surface.	For smoothing or blending cut-down projections or surface defects.
X-shaped serrations	Rubber	20 to 50 durometer	Roughing and polishing	Flexibility of rubber allows entry into contours. Medium polishing and light stock removal.	Same as for standard serrated wheels but preferred for the softer, non-ferrous materials.
Plain face	Rubber	20 to 70 durometer	Roughing and polishing	Plain wheel face allows controlled penetration of abrasive grain. Softer wheels give better finishes.	For large or small flat faces.
Flat flexible	Compressed canvas	About nine densities from very hard to very soft	Roughing and polishing	Hard wheels can remove metal, but not as quickly as cog-tooth rubber wheels. Softer wheels polish to fine smoothness.	Good for medium-range grinding and polishing.
Flat flexible	Solid sectional canvas	Soft, medium, and hard	Polishing	Uniform polishing. Avoids abrasive pattern on work. Adjusts to contours. Can be preformed for contours.	A low-cost wheel with uniform density at the face. Handles all types of polishing.
Flat flexible	Buff section canvas	Soft	Contour polishing	For fine polishing and finishing.	Can be widened or narrowed by adding or removing sections. Low cost. For all types of polishing.
Flat flexible	Sponge rubber inserts	5 to 10 durometer, soft	Polishing	Uniform polishing and finishing. Polishes and blends contours.	Has replaceable segments. Polishes and blends contours. Segments allow density changes.
Flexible	Fingers of canvas attached to hub	Soft	Polishing	Uniform polishing and finishing.	
Flat flexible	Rubber segments	Varies in hardness	Roughing and polishing	Grinds or polishes depending on density and hardness of inserts.	For portable machines. Uses replaceable segments that save on wheel costs and allow density changes.
Flat flexible	Inflated rubber	Air pressure controls hardness	Roughing and polishing	Uniform finishing.	Adjusts to contours.

NOTE: Recommendations in this table are intended as a guide for general shop practice. They may be altered to suit individual requirements.

Fig. 8. Grinding head on a continuous-feed machine showing the serrated, rubber-faced contact roll; a 10-inch wide abrasive belt; and the plumbing used for wet-grinding operations. Spring-loaded rolls on either side of the contact roll hold down strips and non-magnetic parts.

tracking roll, tension being applied through the third roll. Tracking is controlled by manually operated linkage or by air cylinders actuated by limit switches and solenoids. Tensioning may be achieved through either air cylinders or springs.

Horsepower of the drive motor may vary from 3/4 to 2 1/2 hp per inch of abrasive-belt width. For operations where finish is of prime importance, belt pressure against the work is not as demanding as in stock-removal operations.

Running in a horizontal plane directly beneath the vertical work-head is the conveyor belt. It may be made of rubber or may be another abrasive-coated belt. To accommodate a wider range of work, it is sometimes necessary to install cleats or holding fixtures on the belt. The conveyor belt has its own drive roll as well as a tracking and tensioning roll.

A wide range of speeds is available through use of a variable-speed drive unit. This unit is reversible to allow parts to be traversed beneath the grinding head in either direction. Most machines, such as the one illustrated in Fig. 6, have a magnetic conveyor platen centered directly beneath the contact roll of the grinding head. If non-magnetic materials are to be ground, pinch rolls or hold-down rolls may be used.

Both sides of a work-piece can be ground in one pass on the multiple-head, over-and-under type Engelberg machine shown in Fig. 7. The work first rests on the upper conveyor belt and passes beneath the grinding head at the left. It is then carried around to the lower conveyor belt, unground face up, for passage beneath the grinding head at the right. Magnetic platens below each work-head hold the parts firmly on the conveyor during grinding.

Continuous-feeding machines usually handle parts up to 6 inches thick, but this maximum varies with different makes and models. Generally, the length of the part is not limited, but is governed by its shape, material, and ability to remain oriented during the grinding cycle. Parts may be placed on the conveyor either by hand or by hopper feed, or the machine may be included in a continuous-flow production line.

The rate at which work-pieces are finished may vary considerably. Materials being worked, condition of the part before processing (draw marks, pits, rust, scale), and differences in final finish requirements all play a specific role in the selection of the conveyor speed. Because of the many variables, each case must be examined individually. Jobs requiring heavy stock removal, and parts made of dense or hardened metals, should be run at comparatively slow speeds. Finishing applications fall within a speed range varying from 8 to 40 fpm. Deburring operations often can be run at the higher limits of the drive unit.

Selection of the contact roll is as important as that of the abrasive belt. The rolls are available in either steel, synthetic rubber, natural rubber, or a combination of the last two substances. Steel contact rolls are used where heavy stock removal or close tolerance is the prime requisite, while rubber rolls are used for light stock removal or where high finishes are required. In the case of a rubber contact roll, using a given abrasive grit, the harder the roll the poorer the finish. However, the rate of stock removal will increase as the hardness increases.

In operations employing a coolant, contact rolls —either steel or rubber—are usually grooved or serrated. A rubber-faced, serrated contact roll carrying a 10-inch wide abrasive belt can be seen in Fig. 8. These serrations, or grooves, provide an

Table 2. Selection and Application of Abrasive Belts

Work-Piece Material	Type of Operation	Abrasive Belt*	Grit	Belt Speed, sfm	Lubricant	Contact Wheel	
						Type	Hardness, Durometer
Hot- and cold-rolled steel	Roughing	R/R Aluminum oxide†	24 to 60X	4000 to 6500	Dry or light-bodied grease	Cog-tooth, serrated rubber	70 to 90
	Polishing	R/G or R/R Aluminum oxide‡	80 to 150X	4500 to 7000	Dry or light-bodied grease	Plain or serrated rubber, sectional or finger type cloth wheel, free belt	20 to 60
	Fine polishing	R/G or Electro-coated aluminum-oxide cloth (jeans weight)	180 to 500	4500 to 7000	Heavy grease or grease with abrasive compound	Smooth-faced rubber or cloth	20 to 40
Stainless steel	Roughing	R/R Aluminum oxide	50 to 80X	3500 to 5000	Dry or light-bodied grease	Cog-tooth, serrated rubber	70 to 90
	Polishing	R/G or R/R Aluminum oxide	80 to 120X	4000 to 5500	Dry or light-bodied grease	Plain or serrated rubber, sectional or finger type cloth wheel, free belt	30 to 60
	Fine polishing	Closed-coat silicon carbide	150 to 280	4500 to 5500	Heavy grease or oil mist	Smooth-faced rubber or cloth	20 to 40
Aluminum, cast or fabricated	Roughing	R/R Silicon carbide or R/R aluminum oxide	24 to 80X	5000 to 6500	Light grease	Cog-tooth, serrated rubber	70 to 90
	Polishing	R/G Silicon carbide or R/G aluminum oxide	100 to 180	4500 to 6500	Light grease	Plain or serrated rubber, sectional or finger type cloth wheel, free belt	30 to 50
	Fine polishing	Closed-coat silicon carbide or electro-coated aluminum oxide	220 to 320	4500 to 6500	Heavy grease or grease with abrasive compound	Plain faced rubber, finger type cloth, or free belt	20 to 50
Copper alloys or brass	Roughing	R/R Silicon carbide or R/R aluminum oxide	36 to 80X	2200 to 4500	Light-bodied grease	Cog-tooth, serrated rubber	70 to 90
	Polishing	Closed-coat silicon carbide or electro-coated aluminum oxide (jeans weight) or R/G silicon carbide or R/G aluminum oxide	100 to 150	4000 to 6500	Light-bodied grease	Plain or serrated rubber, sectional or finger type cloth wheel, free belt	30 to 50
	Fine polishing	Closed-coat silicon carbide or electro-coated aluminum oxide (jeans weight)	180 to 320	4000 to 6500	Light grease or grease with abrasive compound	Same as for polishing	20 to 30
Non-ferrous die-castings	Roughing	R/R Silicon carbide or R/R aluminum oxide	24 to 80X	4500 to 6500	Light-bodied grease	Hard wheel depending on application	50 to 70
	Polishing	R/G Silicon carbide or R/G aluminum oxide	100 to 180X	4500 to 6500	Light-bodied grease	Plain rubber, cloth, or free belt	30 to 50
	Fine polishing	Electro-coated aluminum oxide (jeans weight) or closed-coat silicon carbide	220 to 320	4500 to 6500	Heavy grease or grease with abrasive compound	Plain or finger type cloth wheel, or free belt	20 to 30
Cast iron	Roughing	R/R Aluminum oxide	24 to 60X	2000 to 4000	Dry	Cog-tooth, serrated rubber	70 to 90
	Polishing	R/R Aluminum oxide	80 to 150X	4000 to 5500	Dry	Serrated rubber	30 to 70
	Fine polishing	R/R Aluminum oxide	120 to 240X	4000 to 5500	Light-bodied grease	Smooth-faced rubber	30 to 40
Titanium	Roughing	R/R Silicon carbide or R/R aluminum oxide	36 to 50X	700 to 1500	Sulphur-chlorinated grease stick	Small-diameter, cog-tooth serrated rubber	70 to 80
	Polishing	R/R Silicon carbide	60 to 120X	1200 to 2000	Light-bodied grease	Standard serrated rubber	50
	Fine polishing	R/R Silicon carbide	120 to 240X	1200 to 2000	Light-bodied grease	Smooth-faced rubber or cloth	20 to 40
Inconel X Inconel 700 Nimonic 80 Nimonic 100 Nimonic 90 Stellite 27 Waspalloy Hastelloy	Roughing	R/R Aluminum oxide	24 to 50X	4000 to 5500	Sulphur-chlorinated grease stick	Smooth-faced steel or cog-tooth serrated rubber	70 to 90
	Polishing	R/R Aluminum oxide	40 to 100X	4000 to 5500	Light-bodied grease	Serrated rubber	70
	Fine polishing	R/R Aluminum oxide	100 to 150X	4000 to 5500	Light-bodied grease	Smooth-faced rubber	50
S-816	Roughing	R/R Aluminum oxide	24 to 50X	4000 to 5500	Sulphur-chlorinated grease stick	Smooth-faced steel or cog-tooth serrated rubber	70 to 90
	Polishing	R/R Aluminum oxide	40 to 100X	4000 to 5500	Light-bodied grease	Serrated rubber	70
	Fine polishing	R/R Aluminum oxide	100 to 150X	4000 to 5500	Light-bodied grease	Smooth-faced rubber	50

*It is recommended that all abrasive belts have a jeans-weight cloth backing.
†R/R indicates that both the making and the sizing bond coats are resin.
‡R/G indicates that the making coat is glue and the sizing coat is resin.

NOTE: Recommendations contained in this table are intended as a guide for general shop practice. They may be altered to suit individual requirements.

escape path for the coolant, preventing slippage of the abrasive belt. Slippage may cause excessive wear on the backing material of the abrasive belt, crushing of the abrasive grain, an inferior finish on the work, damage to the contact roll, and may also nullify the action of the tracking mechanism, allowing the belt to shift widely and become damaged.

Serration angles, as well as the width of the lands and grooves, may be changed, although, in most cases, the land and grooves are of equal width. If the lands become too narrow, excessive shedding of the abrasive grain may result. Stock-removal rolls have either a 45- or a 60-degree angle of serration. Rolls having a 50- or 60-durometer hardness usually have a 45-degree angle; finishing rolls having a 30-durometer hardness can be procured with a spiral serration, giving the roll a softer action. All rubber rolls, regardless of durometer hardness or type of serration, should be trued after installation. Where possible, this should be done while operating at the same surface speed to be encountered during use. Several types of contact wheels—their surface style, hardness, purpose, and action—are presented in Table 1.

Some continuous-feed machines are designed to have the abrasive belt run at a fixed speed—usually 5000 to 5500 sfm. On machines having a variable speed the range is from 2100 to 8000 sfm. Lower speeds are used with dense, tough, or hard materials, and in some applications, on plastic. Higher speeds are used for average workable steels and non-ferrous materials where the correct contact wheel, belt, coolant, and feed-through speed are used. If glazing develops or persists, a lower surface speed may be necessary. In Table 2 are given the suggested type, grit, and operating speed of abrasive belts; lubricant; and type and hardness of contact wheel for various work-piece materials and operations.

Practically all types of coolant filters can be used in conjunction with these flat-finishing grinders. When working toward a high finish, a good filtering system is a must. Any recirculation of a coarse abrasive grain or piece of foreign material may cause a deep scratch or surface abrasion, making rework necessary.

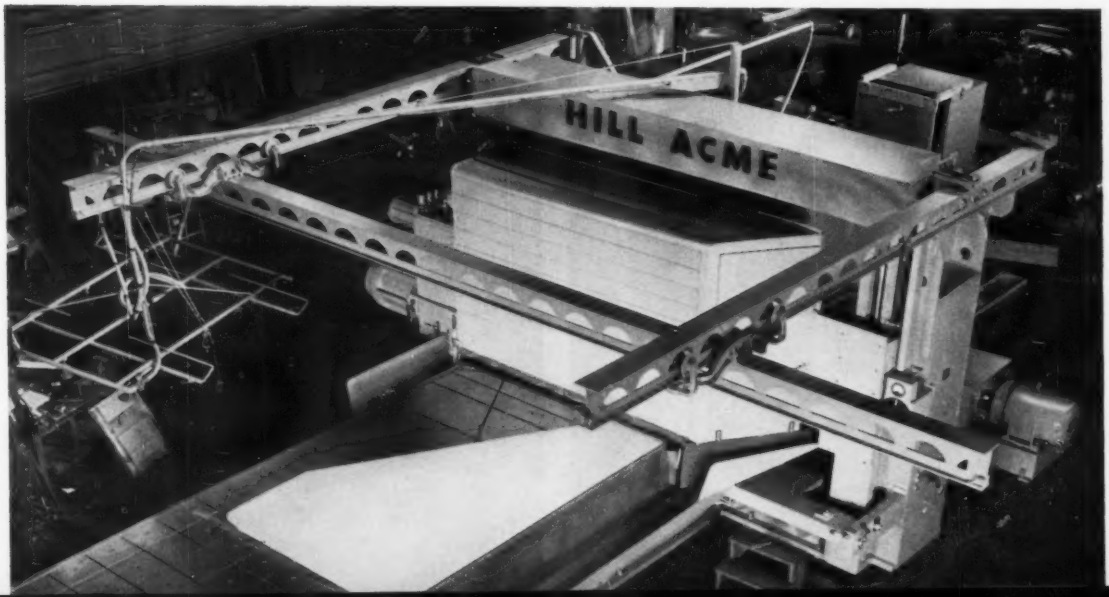
On most machines, tolerances of plus or minus 0.001 to 0.002 inch can be held. This is dependent, to a great extent, on the original condition, shape, and size of the part being processed; the contact roll used; the amount of stock being removed; and the cooling capabilities of the coolant or lubricant. Soft-rubber conveyor belts tend to increase the tolerance spread: hard-rubber and abrasive-coated conveyor belts give better results.

Conditions of warp or twist in the material being ground are difficult, and in many cases impossible, to remove. Warp across the material can be removed, provided the part is rigid enough to prevent deflection, has enough excess material to allow the warp to be cut out, and can be ground on both sides.

Lapping Crankshafts and Camshafts with Abrasive Belts

Spooled strips of abrasive-coated cloth or paper serve as the polishing medium in special machines for lapping crankshaft bearing surfaces. In many

Fig. 9. Aircraft skin-grinding machine can be used to grind compound tapers on thin sheet metal by means of a wide abrasive belt. The work-piece is held to a reciprocating work-table by vacuum as it is passed beneath the contact roll.



such machines, the work-piece is reciprocated through a distance of 1/16 to 3/16 inch throughout the lapping cycle while a headstock drive rotates the crankshaft. Lapping arms are carried on a hydraulically operated pivoting frame. Each arm is fitted with a pair of shoes which clamp over the journal being lapped, holding the abrasive-coated strip firmly against the bearing.

A take-up spool for the used abrasive strip is provided for each lap shoe. Winding is usually manual: the operator merely turns the spools the required amount before each shaft is lapped. Filtered mineral oil is flowed over the lapping shoes. Other types of crankshaft and camshaft lapping machines use rubber platens that are contoured to the work. On these machines, the abrasive paper rolls are fed by positive indexing, which maintains an even rate of lapping and results in a consistent finish.

Still another machine drives an abrasive-coated belt at a speed of 3700 sfm over bracket-mounted pulleys. These brackets can be positioned along tubular ways so that the belt engages successive bearing surfaces. The cloth belts used are 1 to 2 inches wide by 91 inches long, with 240- or 320-grit aluminum-oxide abrasive.

Sheets, Coils, and Strips Can Be Readily Surfaced

Grinding and polishing metal in sheet, strip, coil, or bar form is possible with abrasive-coated belts in widths of 7 feet or greater. Several types of machines have been developed to suit the requirements of a wide range of industrial applications.

These machines all drive the wide abrasive belts over a set of two to four rolls and have provision for tensioning by either pneumatic or hydraulic pressure. A rubber contact roll of selected hardness backs up the belt at the point of contact with the work. Pressure of the material against the belt is controlled by a steel support roll under the work that can be raised or lowered by air. Beyond these basic features, equipment differs only in the manner of presenting the metal to the grinding head.

In the stainless-steel industry, where controlled and graduated finishes are required to bring out the full aesthetic quality of the metal, a sheet polisher is used. The Mattison wide-belt sheet grinding and polishing machine shown in the illustration on page 121 is a typical unit. The steel

Fig. 10. Work-head of grinding machine shown in Fig. 9. A silicon-carbide abrasive belt, 86 inches wide by 138 inches long, is partly removed from the grinding-head housing. Abrasive-belt height can be accurately adjusted to control stock removal.

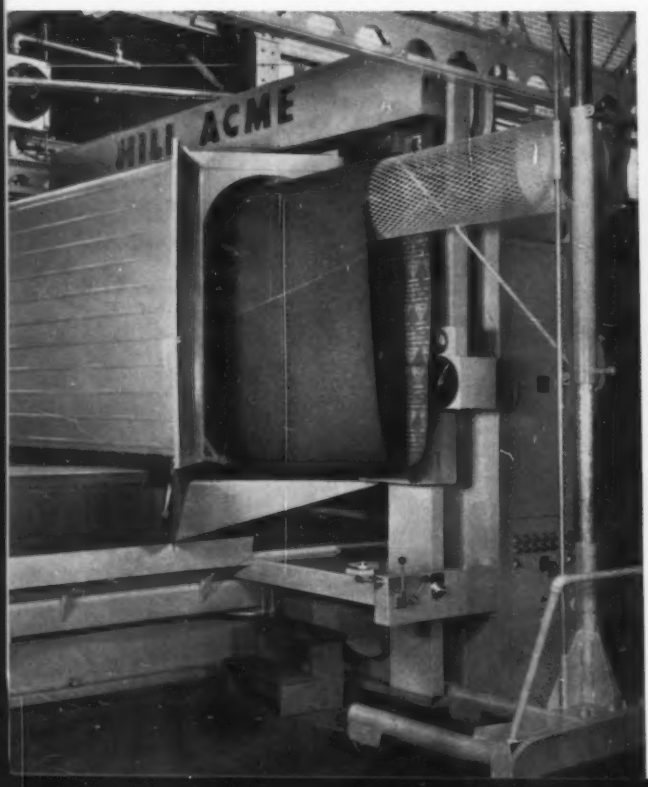


Fig. 11. Pressed-steel knife handles by the thousands are being automatically ground to flatness on this vertical-platen grinding machine. A continuously operating, chain type fixture conveyor carries the work-pieces across the face of the abrasive belt.

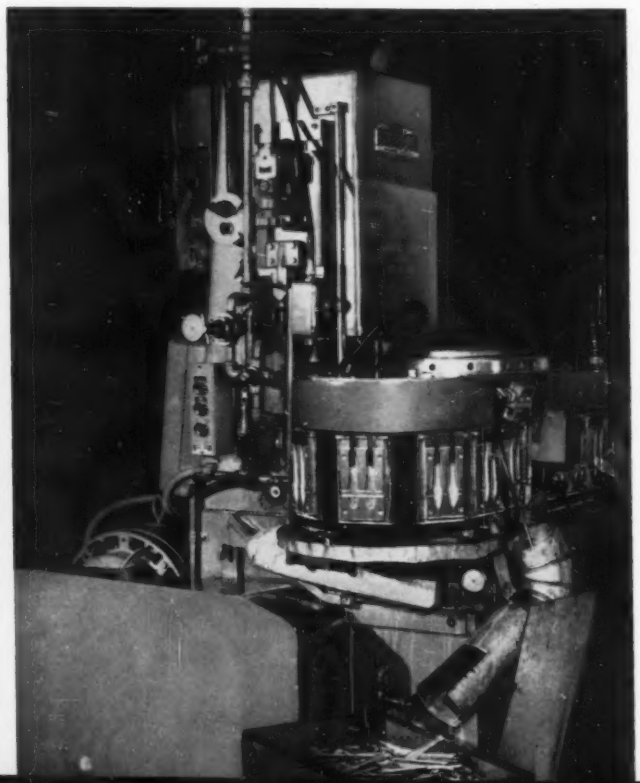
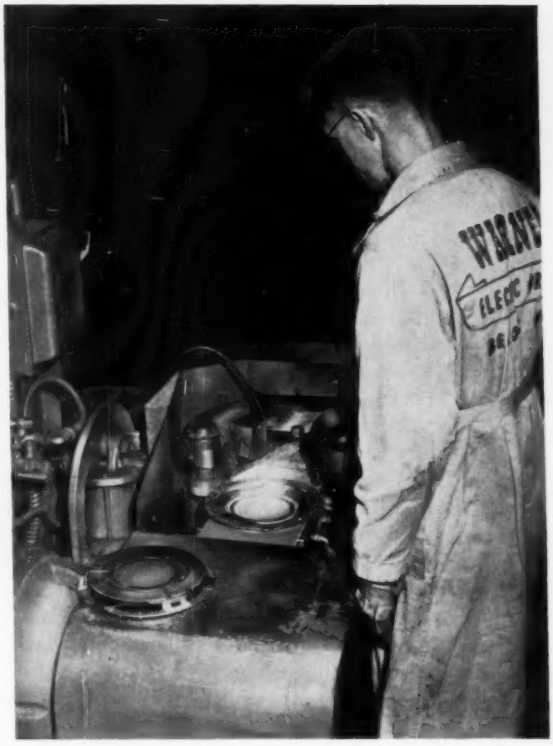


Fig. 12. One face of an automobile clutch plate is being ground flat on this horizontal-platen grinding machine. The clutch plate is rotated on the moving abrasive belt by two small, motor-driven wheels.



sheet is held in position on a reciprocating table by quick-acting clamps. As the work-table reciprocates, the steel sheet is passed back and forth through the grinding gap. After the work has been polished, a push-button control provides the means of instantly lowering the support roll and moving the table out to facilitate unloading. High finishes are readily obtained.

When the steel must be finished in coil form, polishing is accomplished on a strip machine—the material being unwound from coiling reels, passed under a drag roll, over a support roll, under another drag roll, and then recoiled. If necessary, the coil can be wound back and forth several times until the desired finish is obtained.

Polishing of formed sheet-steel parts before plating is an expensive operation if done by hand. The introduction of wide abrasive belts on pinch-roll machines for high-speed polishing of flat material prior to forming has virtually eliminated hand polishing on this type of part. A typical pinch-roll machine employs power-driven, rubber-covered rolls on each side of the grinding gap to feed the material through it.

Because the material is discharged from the machine after each pass, several machines may be aligned in tandem and the work fed directly from one grinding operation into the next. In this manner, metal sheets may be run through many operations at high speeds to meet production requirements. Such polishing lines often employ fourteen or more machines, with material speeds as high as 60 fpm. Use of a large number of polishing heads permits great flexibility in the sequence of grits selected to process various qualities of steel.

For operations intended to produce highly polished plating finishes, belts are run at a speed of 3800 to 5500 sfm and the material is fed at a rate of 40 to 60 fpm. Fine-grain silicon-carbide belts, backed up by smooth-faced rubber rolls of 50 durometer or less, are used in the final passes. The effectiveness of these fine-grain belts can be augmented by the use of oils or greases to "bring up" the finish.

On initial grinding operations aluminum oxide is preferred in coarse grits, backed up by hard-rubber rolls of 70 to 85 durometer and having serrated faces. Although work speeds for tandem operation must be the same as for the rest of the line, in isolated operations poor surface conditions can be overcome by using slower belt and material speeds.

Resin type belts used with heavy cutting oils permit heavy grinding operations, making commercially possible the use of poorly surfaced materials. Because of the added cooling effect of both thin and water-soluble oils, grinding can be done on thin sheets of material.

A large, double-housing abrasive-belt grinding machine constructed for thin-sheet or skin grinding can be seen in Fig. 9. Made for the aircraft industry, this Hill Acme machine will grind both flat and tapered aluminum wing- and fuselage-skins. Accurate compound tapers can be ground by tilting the table on which the skins are held by vacuum. The table passes the work back and forth under an 86-inch wide by 138-inch long, silicon-carbide abrasive belt, which can be accurately raised or lowered to control stock removal. The abrasive belt is shown partly removed from the grinding-head housing in Fig. 10.

Flat-Platen Grinding

When flatness or a straight grinding-line pattern are the main work-piece considerations, a flat platen is used on the machine. The platens are of various types: steel, tungsten carbide, cast iron, or glass may be used in specific applications.

Flat-platen grinders are either vertical or horizontal and, in some cases, are set up in production lines. Working width of this type grinder ranges from 1/2 to 24 inches, depending on the application. Some platen grinders are designed for dry grinding only, while others can be operated either wet or dry.

The Porter-Cable vertical platen grinder shown in Fig. 11 utilizes a fixture conveyor to carry pressed-steel cutlery past the abrasive belt. In this operation, knife handles are being loaded by hand, then polished and unloaded automatically.

On grinders designed solely for offhand grinding, the operator presents the part to an abrasive belt that is backed up by a platen. Although this method produces a fairly flat surface, it is not suitable for precision work.

Some types of platen grinders have a work-table that can be adjusted to any angle from 90 to 45 degrees to produce a flat-angle grind on the part. Work-tables on most such machines have a slot in which an adjustable protractor can be inserted to grind and finish compound angles. This type of equipment will usually suffice when flatness and angle, rather than precision, are the critical factors.

Other platen type grinders, especially those which use wide belts, are set up horizontally. The part to be ground is usually large and is intended to be flat-ground. It is placed on the abrasive belt (backed up by a flat platen), the weight of the work-piece creating the pressure necessary for grinding the flat surface.

This type of machine usually has a fence, or stop, across the face of the belt to prevent the work-piece from shifting its position during grinding. Such a machine is for flat grinding only, not for precision work, and is available for either wet or dry operations. A horizontal-platen machine is shown flat-grinding an automobile clutch plate in Fig. 12. The clutch plate rests on the abrasive belt and is rotated by two small, motor-driven wheels—one on either side of the belt.

Still other platen type grinders are manufactured to perform precise work. Once the unit has been properly set up, an inexperienced operator can turn out precision work at production speeds. In some cases parts do not require special fixturing, but are placed on the work-table and clamped against pre-set, adjustable locating blocks. The table is then fed in as shown on the Engelberg machine in Fig. 13, either manually or semi-automatically, to a stop on the table.

Whenever possible, the work-piece should be moved across the face of the belt during grinding. This is to utilize its full width, to hold close tolerances, to maintain uniform finishes, and to avoid grinding a step on the part, particularly when it is wide or is being moved to a new or unused area of the abrasive belt. The success of flat-platen grinding depends, to a large degree, on the size and shape of the work-piece. For example, a square part should not normally exceed 10 square inches unless it has holes, concavities, serrations, or the like, which provide chip clearance.

Fig. 13. A pneumatically operated work-holding device and a micro-adjustable work-table permit close-tolerance finishing on this vertical-platen grinding machine. The table is fed toward the abrasive belt, either manually or semi-automatically, up to a pre-set stop.

Belt Speeds Have a Direct Effect on Grinding Results

Many items bear either directly or indirectly on the satisfactory outcome of an abrasive-belt grinding operation. Included are the belt backing, bond, type of grit, grit size, belt speed, type and pattern of contact wheel, nature of lubricant, and other factors. These variables tend to militate against the value of arbitrary recommendations. However, the recommended belt speeds given in Table 2 reflect considerable experience and, to a great extent, general industrial practices in metal-finishing with abrasive-coated belts.

A few exceptions may be noted. In extremely

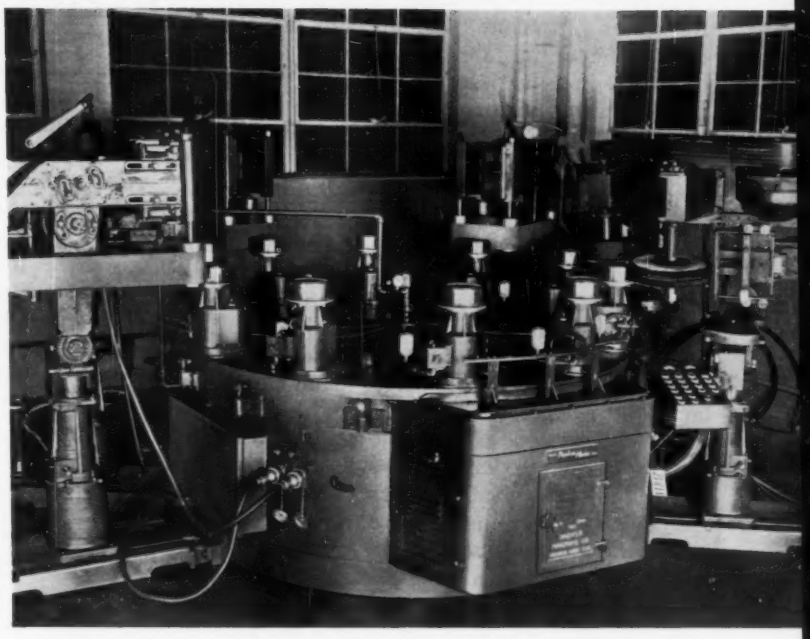


Fig. 14. Four general methods of work-holding are employed for abrasive-belt finishing: vacuum chuck, mechanical linkage, modified conveyor belts, and magnetic platen. Vacuum chucking is used on this automatic polishing installation to secure the parts on rotating work-holders.

heavy-duty grinding, for example, recommended belt speeds will range from 3800 to 5000 sfm. Generally, speeds of 4500 to 5500 sfm are used for snagging and grinding. For polishing and oiling out, the speeds should be increased to 6000 or 6500 sfm. Much of the equipment currently in use is designed to operate at a speed of 7000 sfm only. Speeds in excess of this are regarded as detrimental to belt life.

Contoured Surfaces Finished with Wearable Abrasive Wheels

Production economies in the grinding and polishing of formed or contoured surfaces are being achieved with wearable wheels consisting, from rim to hub, of tightly packed radial "spokes" of plain or folded abrasive cloth. Mounted on a polishing lathe, these wheels are first shaped to the work-piece—a template faced with an abrasive sheet is merely pressed against the face of the wheel. Once shaped, the wheel holds this contour throughout its life.

Wearable abrasive wheels require a minimum of lubrication, tend to resist loading when used on non-ferrous metals and, generally, require much less power, width for width, than a belt. They are made in diameters ranging from 5 to 17 inches, and in face widths varying from 1 to 7 inches. The abrasive may be silicon carbide, aluminum oxide, or garnet with recommended speeds ranging from 1500 to 2600 rpm. Shields of cloth or paper cover the sides of the wheel to reduce air blast. Support cages, or flanges, of the wheel are reusable, change-over time being insignificant.

Working life of these wheels, even on production runs, is measured in days or weeks—many times that of a belt. Accordingly, down time is virtually eliminated and abrasive cost per part is reduced greatly.

Work-Holding and Lubrication for Abrasive-Belt Grinding

Parts are held in position against the abrasive medium in any of four general ways: by vacuum chuck, mechanical linkage, magnetic platens, or by modifying the conveyor belt in the case of an automatic transfer setup. In the first instance, a vacuum serves to hold the part on the fixture as is the case on the packer automatic, rotary polishing installation shown in Fig. 14. Use of vacuum requires a closed port or a surface which can be sealed at the edges to avoid air leakage.

When mechanical linkage is used, the part is held to the fixture by latches or by an expandable-center supporting plug. With this method, trips may be used to release the parts at the unloading station.

Magnetic platens may be designed for use with either alternating or direct current, or may contain permanent magnets. One advantage of the externally powered magnets is that they permit instant release of parts at the unloading point. Permanent magnets are integral parts of

the platen. To insure maximum flux density and holding force, they should be located as close to the work-piece as possible. Although permanent magnets afford simplicity of design and installation, they impede the release of the finished part at the unloading station.

Often, the conveyor belt is used to hold moving parts firmly against the abrasive belt. Sponge- or soft-rubber belts allow the parts to be pressed into their soft surfaces—a common method with parts that cannot be held by magnetic force. Accurate placement of parts on soft-rubber belts is not required, thus permitting more rapid loading.

Many operations make use of metal cleats fastened to the conveyor belt. Parts to be ground or polished are placed on the belt against the cleats and are carried under the work-head of the machine. The cleats must, of course, be thinner than the parts being ground. Cleated conveyor belts, as was the case with soft-rubber belts, work well with parts that cannot be held by a magnetic platen.

A common method of applying lubricants to automatic machines using coated abrasives is by spray. Most spray units consist of an adjustable-stroke pump driven by a reciprocating air motor. A spray-control cylinder triggers the air only when fluid is being delivered to the spray nozzle. Application can be controlled by the quantity of lubricant delivered per stroke of the pump, and by the air pressure at the nozzle. Mist lubrication can also be used on automatic abrasive-belt machines.

Lubricant is piped to the pump from storage tanks having a capacity of 2 to 5 gallons. The unit can be controlled by a solenoid valve placed in the air line and operated from the machine circuit. By doing this, lubrication can be stopped and started with the abrasive-belt grinding machine.

Lubricant may also be applied on automatic machines in bar or stick form. The bar or stick lubricant is placed in a holding fixture and fed into the abrasive belt. Feeding is accomplished by an air cylinder attached to the fixture and tripped by a solenoid. Rate of infeed is determined by a ratchet on the holding fixture. Some machines use a gravity-feed unit to supply lubricant to a brush, which then wipes the part to be finished before it is indexed into the grinding or polishing position.

Die Polishing

Die-polishing operations can be carried out on abrasive-belt grinding machines such as the one shown in Fig. 15. On this particular machine the horizontal work-table is slide-mounted and revolves while a vertical abrasive belt contacts the inner surface of the die. Polishing action is, therefore, parallel to the eventual direction of work movement through the die.

Two machine sizes will accept dies with internal diameters up to 3 1/2 and 9 inches. Dies may be rotated at speeds of 80 and 180 rpm, or 60 and 150 rpm, respectively. The cloth-backed abrasive belts are 75 and 102 inches long, ranging in width from 1/8 to 1/2 inch, and are operated at a speed of 5000 sfm.

The abrasive belt runs on a drive pulley above the work and a smaller pulley, manually tensioned, below it. Immediately above the work-table is a pair of small, adjustable idler pulleys which guide the abrasive belt into contact with the inside surface of the die. A similar pair of idler pulleys below the work-table can be adjusted to a smaller span in order to avoid a bell-mouth at the discharge end of the die.

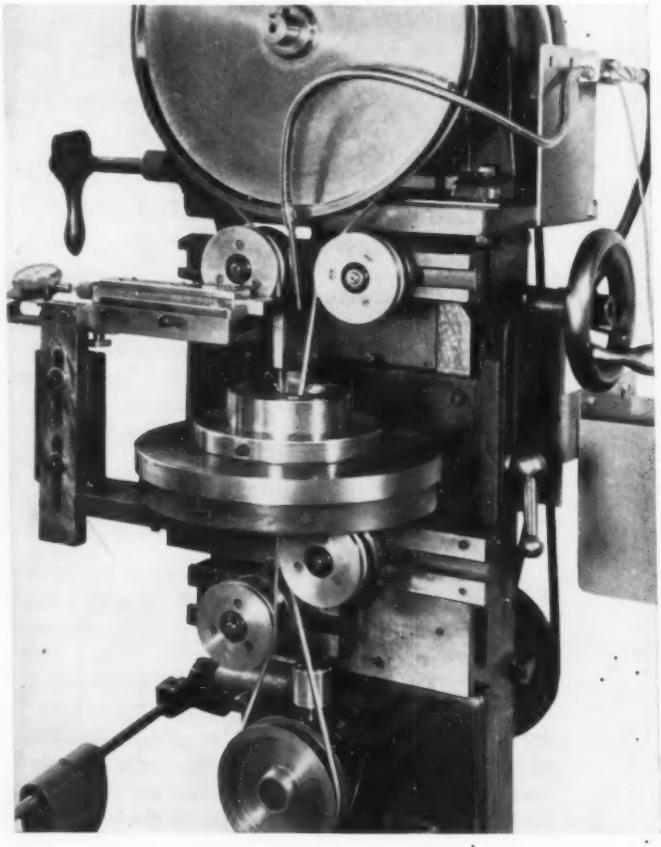


Fig. 15. Internal radii of a drawing die are being finished by an abrasive-coated belt on this automatic die-polishing machine. A pair of idler pulleys below the work-table can be adjusted to avoid bellmouthing of the polished die surface.

65 Engineering Students Win Machine Design Awards

The following 1958 graduates have been named by their respective engineering colleges as the recipients of MACHINERY's Achievement Award for outstanding excellence in machine design. In two instances awards were given to the two leading machine design students in their respective graduating classes because of the closeness of their standing.

This is the third year that MACHINERY has presented these achievement awards. Sixty-three engineering colleges participated as against fifty-seven in 1957.

Alabama Polytechnic Institute	THOMAS D. BURSON	Anniston, Ala.
Carnegie Institute of Technology	ROBERT R. STEPHENSON	Mt. Carmel, Conn.
Case Institute	RICHARD C. HANZEL	Cleveland, Ohio
City College	VICTOR VIGLIOLI	New York City
Colorado School of Mines	RICHARD C. MOCKBEE	Kalispell, Mont.
Colorado State University	HARRY B. DOWNS	Fort Collins, Colo.
Cooper Union	DAVID S. MARGOLIAS	New York City
Cornell University	RICHARD S. MOELLER	New York City
Dartmouth College	RICHARD D. BUGBEE	Wilmington, Del.
Drexel Institute	JOHN GANA	Doylestown, Pa.
Georgia Institute of Technology	KENNETH H. MERRY	Augusta, Ga.
Illinois Institute of Technology	ROBERT PAWLAK	Cicero, Ill.
Johns Hopkins University	JOHN M. SHEEHAN	Baltimore, Md.
Lafayette College	JOHN P. UNGERMAN	Hatboro, Pa.
Lehigh University	THOMAS F. BECHTEL	Easton, Pa.
Massachusetts Institute of Technology	WAYNE W. O'NEILL	Salem, Mass.
Michigan State University	KEITH D. SALISBURY	East Lansing, Mich.
Newark College of Engineering	VINCENT A. BLANDO	Paterson, N. J.
New York University	ERICH PLAUT	Glen Head, N. Y.
Northwestern University	EDWARD HARTFIELD	Northfield, Ill.
Norwich University	WILLIAM A. MRAZ	Middlebury, Vt.
Ohio State University	ROBERT E. MANN	Dayton, Ohio
Oklahoma State College	O'NEILL BURCHETT	Seiling, Okla.
Pennsylvania State University	JOSEPH A. DOPKIN	Shenandoah, Pa.
Polytechnic Institute of Brooklyn	ANTHONY L. BIANCHI	New York City
Pratt Institute	IRVING RUBIN	New York City
Princeton University	NORMAN D. KURTZ	Woodmere, N. Y.
Purdue University	RUSSELL E. LENHART	Valparaiso, Ind.
Rensselaer Polytechnic Institute	GERHARD KAESS	Troy, N. Y.
Rice Institute	ELDON E. YOUNG	Pasadena, Tex.
Rose Polytechnic Institute	KENNETH P. DUNCAN	Terre Haute, Ind.
Stanford University	PATRICK M. MAGEE	Los Angeles, Calif.
Stevens Institute of Technology	LAWRENCE A. FERRARI	Woodridge, N. J.
Union College	ALLEN J. BAKER	Kenmore, N. Y.
University of Alabama	HUGH M. PRIVETT III	Selma, Ala.
University of Arizona	JOSEPH J. MULLIGEN	Safford, Ariz.
University of California	JOHN C. BASS	Oakland, Calif.
University of Colorado	FRED M. RHODES	Boulder, Colo.
University of Connecticut	ROBERT C. BABBIT	Willimantic, Conn.
University of Idaho	WILLIAM W. COOKE	Boise, Idaho
University of Illinois	JOHN GARBA	Urbana, Ill.
University of Kansas	JAMES M. HEALZER	Lawrence, Kan.
University of Maine	GORDON WORMELL	Woodland, Me.
University of Maryland	EDWIN S. ELSTE	Baltimore, Md.
University of Massachusetts	GERALD F. CROWLEY	Springfield, Mass.
University of Minnesota	ROBERT D. MOHRBACHER	Minneapolis, Minn.
University of Nebraska	CHARLES E. SHEETS	Elgin, Neb.
University of Notre Dame	THOMAS N. FOGARTY	St. Joseph, Mo.
University of Pennsylvania	ALAN SOLER	Philadelphia, Pa.
University of Pittsburgh	NICHOLAS KAKAVIS	Pittsburgh, Pa.
	JOHN J. VRANKA	Johnstown, Pa.
University of Rhode Island	SYDNEY A. SPINK	Wakefield, R. I.
University of Southern California	RICHARD F. SHOLTIS, JR.	Los Angeles, Calif.
University of Texas	CHARLES E. GALLISHAW	Houston, Tex.
University of Utah	DONALD R. SNOW	Salt Lake City, Utah

(Continued on next page)

University of Washington	Jack H. Wires	Seattle, Wash.
University of Wisconsin	Walter F. Marten	Madison, Wis.
Virginia Polytechnic Institute	David W. Paxton	Covington, Va.
Washington State College	Robert G. Clem	Richland, Wash.
Wayne University	Rudolph Sbroglia	Detroit, Mich.
Wentworth Institute	Frank L. Cheever	Belmont, Mass.
	John M. Clapp	Greenfield, Mass.
West Virginia University	Larry G. Shuck	Rainelle, W. Va.
Worcester Polytechnic Institute	Howard B. Pritz	Larchmont, N. Y.
Yale University	James F. Beckman	Fort Worth, Tex.

Opposed Tools Simultaneously Machine Hollow Hemispheres

Simultaneous spherical boring and turning of the inner and outer surface of large, aluminum, hollow hemispheres are now being successfully accomplished on a Heald Bore-Matic boring machine, according to application engineers at the Heald Machine Co., Worcester, Mass. By finishing both surfaces simultaneously, production is substantially increased over setups requiring individual boring and turning operations performed on separate machines. Concentricity between the two surfaces is uniform, and because the inner and outer tool pressures neutralize each other, a heavier cut can be taken without distorting the shape of the relatively thin-walled part.

The work is clamped by the rim in a rotating fixture arranged to pivot on a vertical axis at the center of curvature. Stationary opposing tools mounted on two hydraulically operated slides bore and turn the rotating work-piece simultaneously, producing the desired hemispherical shape and wall thickness.

Rotation of the work-piece is started by depressing a push-button, and the two tools are fed in to take their cuts. When the tools reach the pre-set depth of cut, the turntable is automatically started, pivoting the rotating fixture and permitting the spherical surfaces to be machined simultaneously. At end of 90 degrees of turntable rotation, the tools are retracted and the fixture returns to loading position. The work-piece is located by a recessed flange in the fixture.

Size tolerance is held to 0.0005 inch on both surfaces to maintain a uniform wall thickness. A dial indicator held on a pivoted arm permits accurate checking of the finish size before the work is removed from the machine.

As precise control of tool-slide motion can be handled by programming equipment, non-spherical shapes can be duplicated repetitively with high precision on similar machines controlled in this manner. Specialized equipment of this type is now being developed to produce free-form shapes which are variations of a hemisphere.

Simultaneous boring and turning of hollow, aluminum hemispheres are accomplished in this specially equipped boring machine. Fixture pivots rotating part through 90 degrees on a vertical axis as fixed tools generate hemisphere.

* * *

Laboratory for Compacting Field

A test laboratory has been placed in service by the Baldwin-Lima-Hamilton Corporation at its Hamilton, Ohio, plant for research and development work in the field of parts compacting. Tests will encompass the compacting of such materials as metal powders, abrasives, carbides, cermets, ferrites, plastics, and fuels for rockets and missiles.

The laboratory, designed primarily as a service to customers, will provide data for evaluating quality, tolerances, production speed, and the over-all feasibility of producing any part by compacting. Principal facilities include a Baldwin 50-ton compacting press for actual parts production; a production type sintering furnace; and a blender for powders, lubricants, and other materials.

Turret Punch Press Controlled by Optical Locator

An optical locator has been combined with a conventional stylus to broaden the application range of an 80-ton turret punch press. The illustrated RA-101 press, built by the Wiedemann Machine Co., King of Prussia, Pa., reduces the preparation time required to punch panels measuring up to 48 by 60 inches in a single handling, or 48 by 120 inches in two handlings.

Engineering time is minimized, since detailed shop drawings are not required. Only the outside dimensions of the blank must be given—hole-to-hole and edge-to-hole distances are unnecessary. With a rough engineering sketch as a guide, subtemplates for each opening are taped or pasted onto a sheet of transparent vellum. This non-dimensioned master drawing is reproduced photographically on two sheets of sensitized paper, one opaque and one transparent. (Paper shrinkage or stretching is held to a minimum during this process.)

The transparent photocopy is used for checking hole location on the finished part, while the opaque photocopy serves as a template and is held to a vacuum table on the punch press. With the work blank locked in place, the cross-slide is moved until the center lines of a hole location on the template line up with the cross hairs on the ground-glass screen of a 10-power optical head, Fig. 1. After tripping the press, the operator proceeds to the next hole location.

Use of the optical control system and photographic template is intended for small-quantity lots. If a number of identical parts are to be made, 3/8-inch diameter holes can be punched in the first piece at each hole location. This piece can then be used as a template, using the conventional Wiedemann stylus, to increase speed of operation and assure positive hole duplication.

Switching from optical to stylus control, or vice versa, is simplified by mounting both units on a movable locating head. The head can be unlocked and indexed left or right to bring either the optical system or the metal stylus into operating position. Interlocks prevent operation of the machine by the stylus if the optical head is in the control position, and by the optical head if the stylus is in the control position.

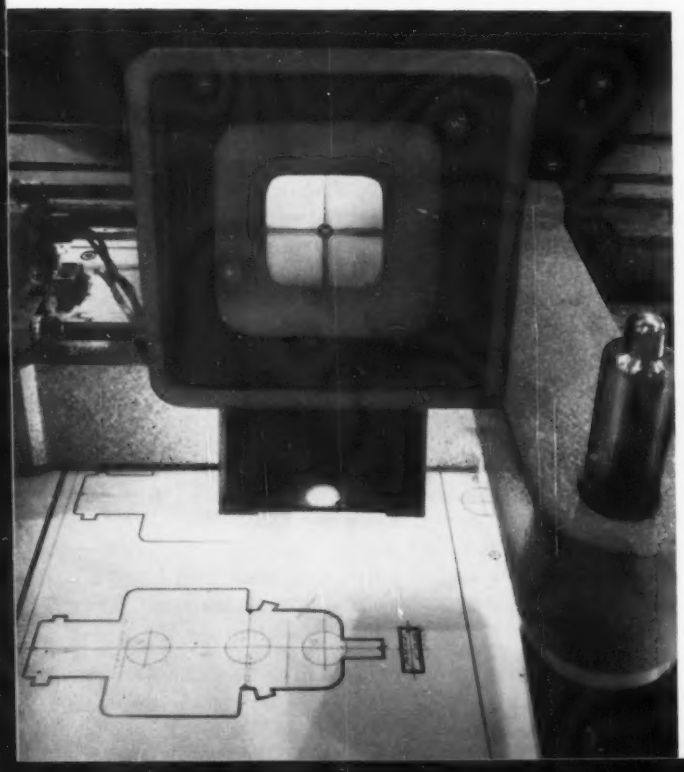


Fig. 1. Hole location on photo-drawing is reflected on the ground-glass screen of a 10-power optical viewing head.

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Juggling Trigonometry to Eliminate a Quadratic Equation

WILLIAM W. JOHNSON

A wedge finger used in the collet-closing mechanism of a screw machine is shown in Fig. 1. To facilitate smooth blending of the various radii of this finger, angles A and B are used in the machining setup. These can be determined with the aid of Figs. 2 and 3 and by the use of trigonometric substitution as a means of simplifying the calculations.

Solution for angle A (Refer to Fig. 2):

1. $(4\ 1/2 + x) \tan A = \dfrac{7}{8}$

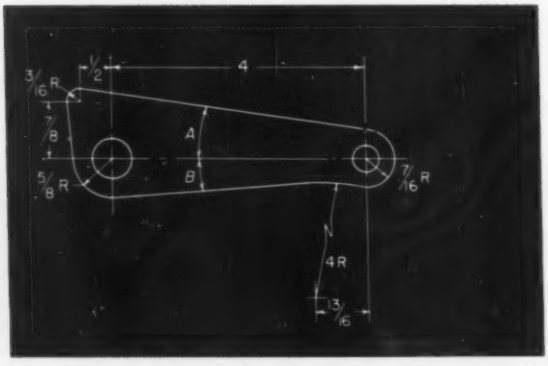


Fig. 1. Wedge finger for collet-closing mechanism.

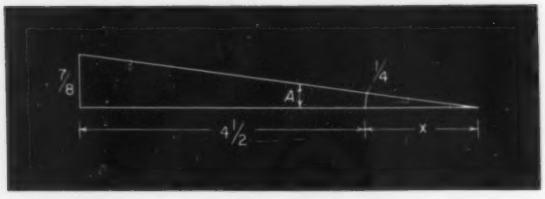


Fig. 2. Geometric relations used to determine angle (A).

2. $x = \dfrac{1}{4 \sin A}$

3. Combining (1) and (2),

$$\left(\frac{9}{2} + \frac{1}{4 \sin A}\right) \frac{\sin A}{\cos A} = \frac{7}{8}$$

4. Simplifying (3),

$$7 \cos A - 36 \sin A = 2$$

5. Equation (4) can be solved in a number of ways, including the trial-and-error method, and also by expressing $\sin A$ in terms of $\cos A$ and using the quadratic formula. However, a novel method, applicable to trigonometric equations of the general type $a \cos A \pm b \sin A = c$, can be used to solve (4) as follows:

6. Let the ratio of the coefficients b and a in the general equation in (5) be the tangent of some angle X:

$$\tan X = \frac{b}{a}$$

7. Combining (5) and (6),

$$c = a \cos A \pm b \sin A$$

$$= a \left(\cos A \pm \frac{b}{a} \sin A\right)$$

$$= a (\cos A \pm \tan X \sin A)$$

$$= a \left(\cos A \pm \frac{\sin X}{\cos X} \sin A\right)$$

$$= \frac{a (\cos X \cos A \pm \sin X \sin A)}{\cos X}$$

$$= \frac{a \cos (X \mp A)}{\cos X}$$

$$\cos (X \mp A) = \frac{c \cos X}{a}$$

8. From (4) the values $b = 36$ and $a = 7$ are substituted in (6) to determine angle X:

$$\tan X = \frac{b}{a} = \frac{36}{7} = 5.14286$$

$$X = 78^\circ\ 59'\ 47''$$

9. From (4) the value of c is seen to be 2; hence, using (7

$$\cos (X + A) = \frac{c \cos X}{a} = \frac{2 \cos 78°59'47''}{7}$$

$$\cos (X + A) = 0.054535$$

$$X + A = 86°52'26''$$

$$X = 78°59'47''$$

$$A = 7°52'39''$$

Solution for angle B (Refer to Fig. 3):

10. From triangle ADC,

$$b = \sqrt{\left(4 + \frac{7}{16}\right)^2 - \left(\frac{13}{16}\right)^2} = 4.3625$$

11. From triangle CFG,

$$u = 3.1875 \sin B$$

12. $x = 0.625 - u = 0.625 - 3.1875 \sin B$

13. From triangle ACE,

$$\cos B = \frac{4 + x}{b} = \frac{4.625 - 3.1875 \sin B}{4.3625}$$

$$4.3625 \cos B + 3.1875 \sin B = 4.625$$

Using the same procedure as was used for solving for angle A in steps (5) through (9), the solution of this equation is as follows:

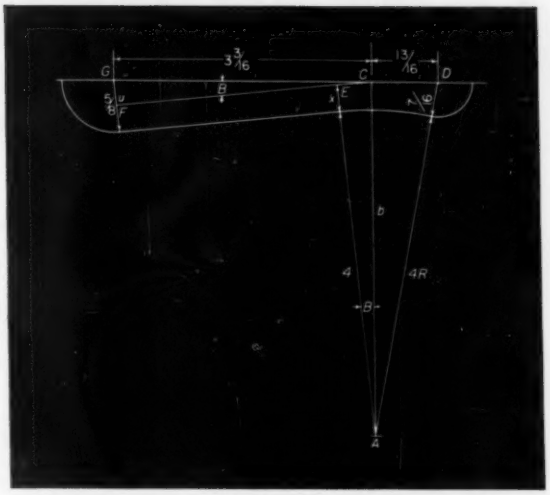


Fig. 3. Geometric relations used to determine angle (B).

14. $\tan X = \frac{3.1875}{4.3625} = 0.73066$

$$X = 36°9'15''$$

15. $\cos (X - B) = \frac{4.625 \cos X}{4.3625} = 0.85602$

$$X - B = 31°7'38''$$

$$B = X - 31°7'38''$$

$$= 36°9'15'' - 31°7'38''$$

$$= 5°1'35''$$

Data-Processing System Corrects Errors at Electronic Speeds

Discovery of a method to insure virtually uninterrupted accuracy in electronic data processing by correcting mistakes "on the fly" has been announced by the Datamatic Division of the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. Called "Orthotronic Control," the new system literally re-creates source data, providing instant reconstruction of words or figures that have been lost or garbled. It is in production, and is intended for service with existing and future Datamatic 1000 systems.

All information is carried on 3-inch wide magnetic tape. This information is transferred from original file cards to the tape by translating it into a series of zeros and ones, resembling the dots and dashes of Morse code. The tape carries thirty-one files, or channels, of such information. At the end of every forty-eight dots and dashes a check number is inserted. The dots and dashes —considered as zeros and ones in the binary number system on which the mathematics of electronic data processing is based—must add up to the check numbers which verify their accuracy. If the dots and dashes do not add up correctly, the machine detects that there is an error in one or more of the previous forty-eight bits which constitute a word in that particular channel. But, it cannot detect which of these bits are wrong.

The business end of Orthotronic Control is an additional, or thirty-second, channel. The presence of a thirty-second bit at the end of each row makes possible a simple mathematical check. If it is a zero, then the sum of all thirty-one bits abreast of it must be an even number. If it is a one, they must add up to an odd number.

The machine then adds across the width of the tape. If the answer does not agree with the thirty-second channel, it detects an error in one of the thirty-one lateral bits. By regularly checking every bit at electronic speed—forty-eight bits at a time lengthwise and thirty-one at a time crosswise—the machine can pinpoint any erroneous bit. It then corrects the error by changing the bit either from a zero to a one, or vice versa. Should there be more than one error among the forty-eight bits, each will be corrected. The entire operation of monitoring and correcting is accomplished in about one-twentieth of a second.

LATEST DEVELOPMENTS

Machine Tools, unit mechanisms, machine parts and

Pratt & Whitney Magnespark Vertical Profiler

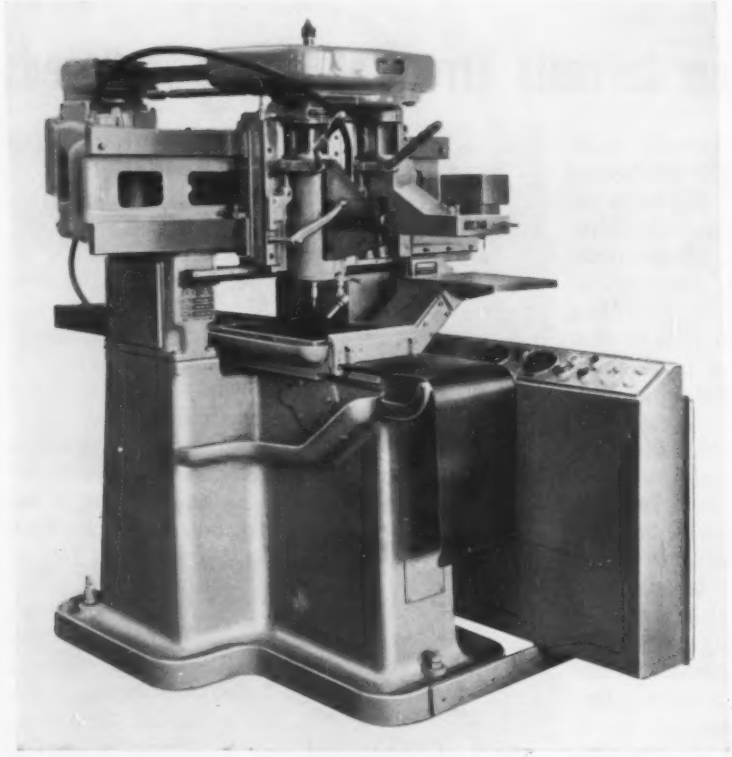
The Pratt & Whitney Co., Inc., West Hartford, Conn., has announced the development of a vertical profiler designated "Magnespark" which embodies a new concept in tracer control for automatic 360-degree profiling. This machine, incorporating spark-gap sensing elements that have been thoroughly proved on the company's Velvetrace milling machines, operates from a sheet-steel profile template to produce any two-dimensional straight-line or irregular contour shape. It operates at speeds up to 60 inches per minute, holding the work to close tolerances.

A unique feature of the machine is the provision for performing tracing operations at a pre-set, constant, surface speed, thus making it possible to produce a better surface finish, as well as assure longer life for the cutting tool.

The high degree of accuracy claimed for the Magnespark machine is attributed to the extreme sensitivity of the tracer coupled with the backlash-free drives to the table and spindle slide. The two spark-gap pick-ups in the tracing head are so sensitive that it takes only a 0.0002-inch deflection of the stylus to activate the table and slide.

Simple tooling, as well as zero tracer pressure which permits the use of soft-steel templates without causing wear, are also features of the profiler. Where quantity production is involved, considerable savings are made possible by employing automatic cycling. The control cabinet is wired to conveniently accommodate automatic cycling components that permit a great variety of operations. If desired the profilers can be furnished tooled, ready for automatic production of specific parts.

Circle Item 101 on postcard, page 161



Magnespark vertical profiler announced by the Pratt & Whitney Co.

Lincoln High-Tensile Electrodes

The Lincoln Electric Co., Cleveland, Ohio, has announced two electrodes for making high-strength joints in alloy steels. These electrodes, "Jetweld LH-90" and "Jetweld LH-110," are iron-powder, low-hydrogen types designed to reduce the cost of welding the increasingly popular, low-alloy and high-strength steels. Jetweld LH-90 is classed E-9018 and also meets the requirements of E-8018-B2. Jetweld LH-110 is classed E-11018.

Jetweld LH-90 is intended for use on high-temperature, high-pressure piping, and on steel fabrication work where either the particular alloy content or the high tensile strength is necessary.

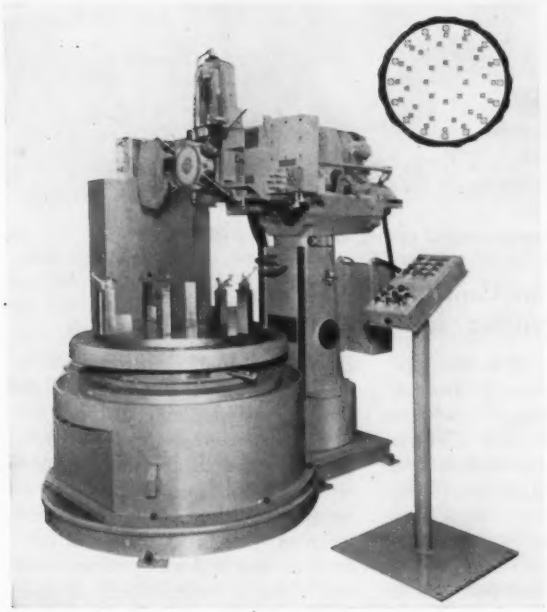
Jetweld LH-110 is intended for use on the new HY-80 and T-1 steels, as well as any other steels that require high-strength joints. The deposits of both electrodes are said to have good impact properties in both the as-welded and stress-relieved conditions. They operate on either direct-current or industrial, alternating-current welding machines and are available in 1/8-, 5/32-, and 3/16-inch sizes.

Circle Item 102 on postcard, page 161

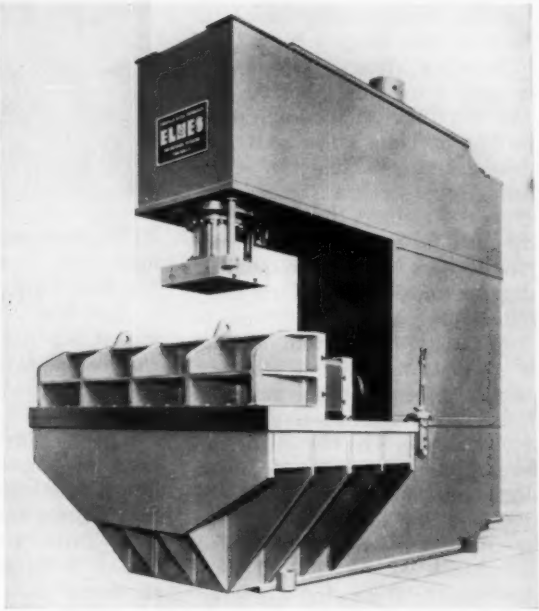
IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON



Burgmaster automatic radial-turret drilling machine



Elmes combination straightening press and bulldozer

Automatic Radial-Turret Drilling Machine with Indexing Circular Table

A special Burgmaster radial-turret drilling machine built up from standard machine components has been announced by the Burg Tool and Mfg. Co., Gardena, Calif. This automatic hydraulic machine has a standard automatic-indexing circular table. It is supplied completely equipped and ready for production, including tools, fixtures, machine and hydraulic power.

The illustration shows the machine arranged for center drilling, drilling and tapping bolt circles having 8-, 13- and 16-hole patterns. The bolt circles are of different diameters and at different levels on a dome-shaped aluminum part. The radial slide is positioned for each bolt circle by a spring-pin locator, after which air clamps secure it rigidly in place.

One machine can perform all operations, but to increase production two machines are used. Each is set up for drilling the holes on two bolt circles. Selection of the hole pattern desired is accomplished electrically from the master-control station. The six-spindle turret is automatically operated and hydraulically controlled.

The machine has the capacity to drill holes 3/4 inch in diameter in mild steel. It provides twelve spindle speeds from 225 to 3000 rpm, which can be increased to sixteen by addition of extra equipment. Ram and spindle power is provided by a two-speed, 2-hp motor. The hydraulic unit also utilizes a 2-hp motor, and three motors supply the table-indexing power for the individual bolt-hole pattern.

Circle Item 103 on postcard, page 161

Combination Straightening Press and Bulldozer

A hydraulic straightening press and a bulldozer combined in one C-frame unit built by the Elmes Engineering Division of American Steel Foundries, Cincinnati, Ohio, recently solved the production and financing problems of a customer. Quotations on two presses: a 300-ton "C" frame press for straightening work, and a 150-ton horizontal bulldozer for forming operations and bulldozing of steel plate, exceeded the customer's appropriation, and it appeared that only the "C" frame press could be purchased. On learning that both presses would not need to be in operation at the same time, Elmes Engineering Division prepared a new estimate covering the specially designed 300- by 150-ton single unit illustrated, in which the functions of both presses were combined. This "two-in-one" press,

built at a cost within the customer's appropriation, has proved very satisfactory.

Circle Item 104 on postcard, page 161

Automatic Forging Machines

The Hill Acme Co., Cleveland, Ohio, has announced a line of automatic upset-forging machines built in sizes ranging from 1 1/4 to 5 inches. Material to be forged is pre-cut to length, heated, and fed into a receiving chute on the forging machine. The parts are then gaged, picked up by work-handling fingers, and passed progressively through the dies. While the material is being moved from pass to pass it can be rotated 90 degrees to assure a uniform forging. Short parts are allowed to drop through the bottom opening of the machine and long parts are ejected to the rear of the machine.

A finished upset forging is produced at every revolution of the forging crank. This development does not limit the number of passes or the length of stock to be used in making a part. The 1 1/2-inch Model XN machine shown in the illustration will forge square or hexagonal bolts 3/4 inch in diameter in lengths up to 24 inches at the rate of 60 bolts per minute.

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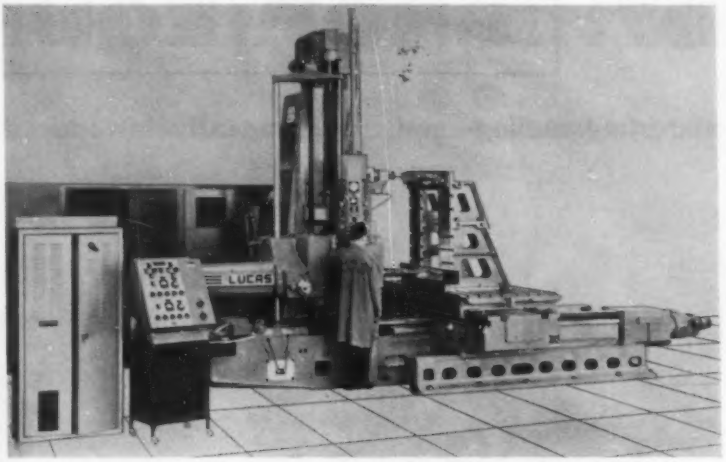


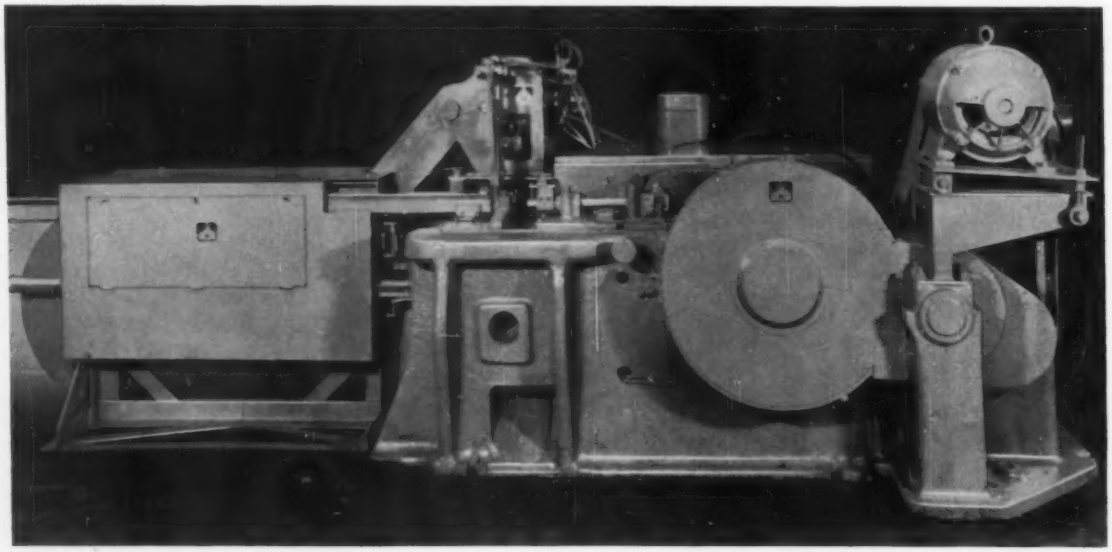
Lucas program-controlled boring, drilling, and milling machine

Program-Controlled Horizontal Boring, Drilling, and Milling Machines

A complete line of table type and floor type horizontal boring, drilling, and milling machines equipped with General Electric program controls is announced by Lucas Machine Division of the New Britain Machine Co., Cleveland, Ohio. Units can be furnished with tracer equipment, numerical positioning equipment (punched tape), or numerical contouring equipment (magnetic tape).

A feature of these machines is their ability to operate either as fully automatic, program-controlled machines or as standard boring, milling, and drilling machines. Change-over from program control to standard control and back again on all models can be accomplished easily in a minimum of time. This choice of controls results in flexible automation useful for a wide variety of special, as well as standard, production work.

Tracer-controlled machines have either one-dimension, two-dimension, selective two-dimen-



Hill Acme automatic forging machine with production capacity of sixty bolts per minute

sion, or three-dimension tracer equipment. Various tracing speed ranges are available. Numerical position control (punched tape) can be furnished for as many as six motions. These motions include the head, table, saddle, horizontal rotary table, vertical rotary table, and spindle feed. Machines with both tracing equipment and numerical position control can perform contouring operations automatically.

Circle Item 105 on postcard, page 161

Bausch & Lomb Direct-Reading Optical Gage

Speed and accuracy in precision measuring of a wide range of small parts are claimed for an optical gage recently developed by the Bausch & Lomb Optical Co., Rochester, N. Y. This all-purpose inspection and quality-control instrument is being distributed in the United States by the DoALL Co., Des Plaines, Ill. It is designated the Bausch & Lomb DR-25 (Direct Reading) optical gage, and is designed to make depth, thickness, height, and diameter measurements. The continuous measuring range is from 0 to 3 inches without the use of master or setting gages. Measurements are read directly on an illuminated, magnified scale graduated in clearly defined intervals of 0.0001 inch, with an accuracy of 0.000025 inch.

To assure positive control of accuracy, the scale is made from a master ruled on the Bausch & Lomb grating ruling engine, an ultra-precision instrument that is used to cut as many as 60,000 uniform grooves per inch on special optical surfaces.

Although the extra-large work-table facilitates the use of special fixtures, most parts need merely be laid on the anvil (flatness accurate to 0.000005 inch) for accurate measurement. A turn of the control knob lowers the spindle until it touches the part. The spindle stops automatically on contact and the measurement can be read instantly on the scale.

Circle Item 106 on postcard, page 161

Steelweld Hydraulically Operated Press Brakes

A line of hydraulically operated Steelweld press brakes has been developed by the Cleveland Crane & Engineering Co., Wickliffe, Ohio. The line includes presses of various capacities up to 2000 tons for bending mild steel, from 10 gage to 2 inches in thickness and in lengths up to 30 feet. It is claimed that the hydraulic design of these press brakes prevents them from being damaged by overloading, and that too heavy a plate will only stop the ram which can be backed away immediately. The power is constant during the entire stroke, which varies from 12 inches for the smallest brake (rated at 200 tons) to 18 inches for the larger machines. Special longer-stroke machines can also be furnished. The 500-ton press illustrated has a stroke of 14 inches, distance between housings of 12 feet, and throat depth capacity of about 16 inches.

The ram may be started, stopped and reversed at any point in the stroke. It need not continue through a complete cycle. This permits inching the ram to the work and backing it away wherever desired. Two speeds are standard for all Steelweld hydraulic brakes, except the smallest model series. High speed is approximately double the slow speed. A third speed, approximately three times as fast as the low speed, is also available as an optional feature. The ram can be made to approach the work and return from it at high speed, but go through the pressing portion of the stroke at slow speed. The tonnage, or operating pressure, may be adjusted to suit the job simply by turning a knob.

Circle Item 107 on postcard, page 161

Bausch & Lomb direct-reading optical gage

Cleveland Steelweld press of 500-ton capacity

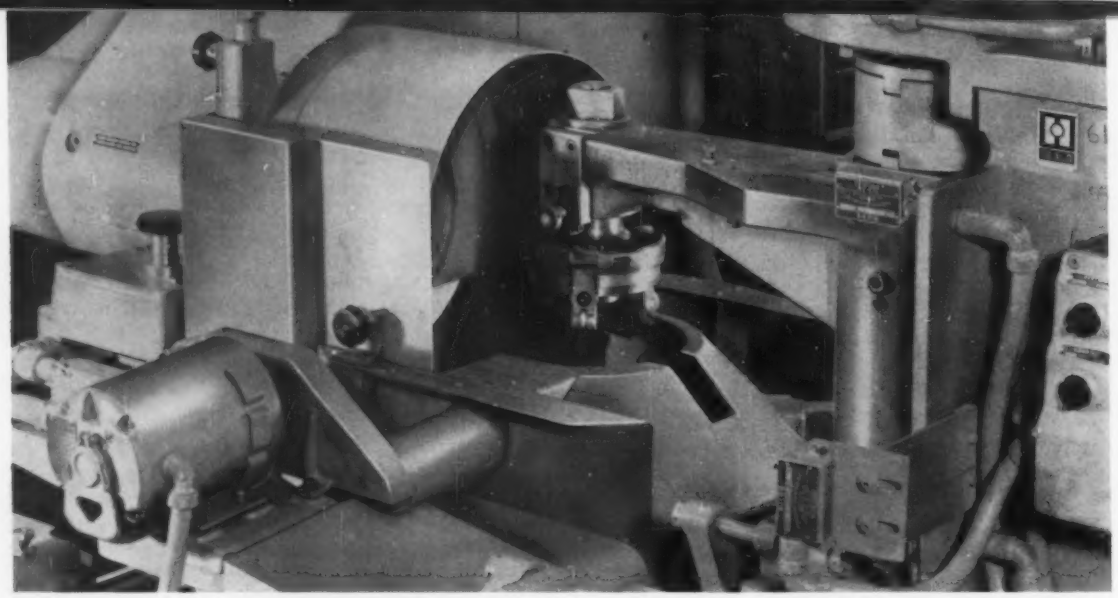


Fig. 1. Close-up of Heald rotary surface grinder with automatic loading mechanism

Heald Automated, Rotary Surface-Grinding Machine

Fully automatic operation with conveyorized loading and unloading has been successfully applied to the Model 261 rotary surface-grinding machine built by the Heald Machine Co., Worcester, Mass. Automation of the rotary surface grinder—not ordinarily considered a high-production machine—is said to have resulted in increased output.

The key to the successful automation of the Model 261 machine shown in Fig. 1 is a hydraulically operated mechanism that loads and unloads the grinder simultaneously. One arm picks up the work-piece from the loading chute, positions it over the rotating table, and inserts it into the air-operated chuck. At the same time, a second arm removes finished work and deposits it in the unloading chute. The entire operation, including the loading-unloading sequence shown in the simplified, schematic diagrams, Fig. 2, is completely automatic.

A gaging station on each unloading chute checks the size of the finished part automatically and actuates signal lights which indicate over- or under-size parts. The gage signal is fed back to the diamond unit, automatically correcting any tendency to drift away from the tolerance limits on the predetermined size.

Starting at upper left-hand corner and reading to the right, diagrams in Fig. 2 show: the table with finished work moved out to the loading position; loading arms moved down to engage work in chuck and loading chute; loading arms raised, carrying two work-pieces; loading arms indexed 90 degrees counterclockwise; loading arms moved down, depositing work in chuck and unloading chute; loading arms moved up, leaving work in chuck and unloading chute; table moved to left for reciprocating grinding operation, and loading arms indexed 90 degrees clockwise; and table moved out to loading position ready to repeat cycle.

Circle Item 108 on postcard, page 161

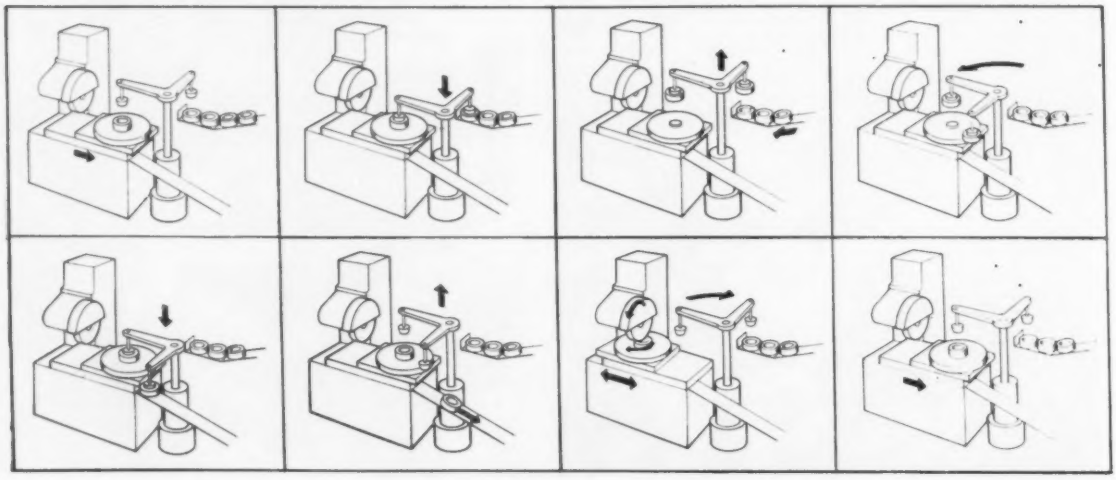
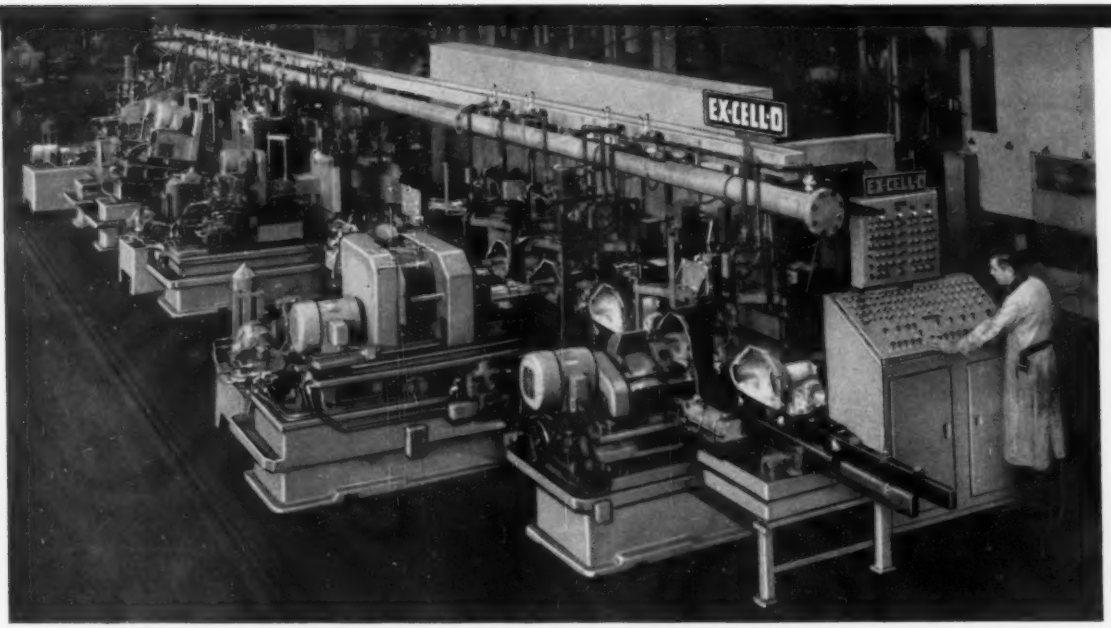


Fig. 2. Diagrams showing sequence of automatic loading and unloading operations of machine illustrated in Fig. 1



Transfer machine built by Ex-Cell-O Corporation for processing aluminum transmission cases

Ex-Cell-O Transfer Machine for Processing Aluminum Transmission Cases

An automated, twenty-four-station transfer machine for multiple-diameter precision boring, facing, milling, air gaging, tapping, and washing has been built by the Ex-Cell-O Corporation, Detroit, Mich. The component is oriented twice during its progress through this machine, once through 90 degrees and later through 180 degrees. The initial operation consists of precision milling the radial joint face flange. The cutter, mounted on a standard Ex-Cell-O precision spindle, is fed into depth and the assembly then traversed through an arc of 225 degrees.

Precision boring of two large diameters and chamfering and facing operations take place at the left-hand side of the fourth station. Three other smaller spindle units finish bore two location holes and a hole 5/16 inch in diameter. On the right-hand side of the same station, another large-diameter boring, facing, and chamfering operation is performed. Diameters previously bored are air gaged on each side of the following station. Tolerances range from 0.0005 to 0.004 inch on the diameters. Several other boring operations are performed at subsequent stations, in each case followed by similar automatic air-gage inspection.

After being rolled over, the component is clamped for the precision fly-cut facing of several bosses. These bosses are on one plane, but necessitate the routing of a cutter in a path equivalent to four sides of a square. Bosses are held flat and in the same plane to within 0.0005-inch total indicator reading. After washing, the component is transferred to the unload station.

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Clearing Torc-Pac Inclinable Presses

The Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill., has recently introduced a line of Torc-Pac open-back, inclinable presses built in 22-, 32-, and 45-ton capacities. These presses feature an air-friction clutch and brake with plates of long-wearing, sintered bronze which operate in an oil bath. The oil bath serves an important function in addition to lubrication. Upon engagement of the clutch, oil is momentarily "trapped" between the plates and begins to transmit the pick-up load before metal-to-metal contact of the plates takes place so that wear is reduced and need for adjustments eliminated.

Fig. 1. (Left) Clearing Torc-Pac press of 32-ton capacity

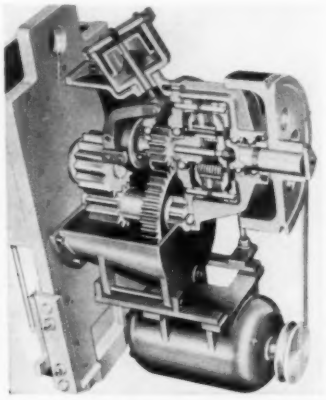


Fig. 2. (Above) Integral drive unit of Torc-Pac press

The integral drive unit of the Torc-Pac press, as shown in the cut-away view, Fig. 2, consists of all working members of the drive and slide—main motor and mount, belts, flywheel, clutch and brake, double reduction gearing, eccentric shaft, pitman, slide, and gibs. The drive can be removed from the press as a single unit. Only six bolts need be removed to dismount the drive from the press for servicing. Operating controls include a four-position selector switch, and run and stop buttons.

Circle Item 110 on postcard, page 161

Lathe for Turning and Burnishing Railway-Car Wheel Axles

A versatile lathe for turning and burnishing railway-car wheel sets and axles at high-production rates has been added to its line by the Hamilton Division, Hamilton, Ohio, of the Baldwin-Lima-Hamilton Corporation. It is a double-carriage, single-end-drive type which can be supplied as an axle lathe. This lathe can also be used for contour-profiling, or as a journal lathe that can be employed as an axle lathe. In addition to machining new and used car-wheel sets and axles, it will turn and burnish end collars, outer journals, dust guards, and inner journals of diesel-locomotive wheel sets with drive gear attached and unmounted diesel axles. The wheel seats of unmounted axles can also be turned and polished.

Features incorporated in the lathe include: independently controlled electronic feeds; hydraulically actuated quill; provision for hydraulic pressure-opposed burnishing; single-end drive; and four selections of speed range. Independently controlled feeds permit the carriage to be returned immediately at completion of one job to make a fast start on a new job. Separate power-feed and traverse electronic drives, which afford an infinite number of speeds in each range, have been developed

Available extra equipment includes: a coolant system for directing coolant onto tools; toolholder for high-speed steel forming tools; special, adjustable, leveling blocks; driver plates for two special axle sizes; and sets of stellite burnishing rolls in place of the regular high-speed steel rolls. An automatic loading device is available for this arrangement. The lathe has a bed length of 18 feet, center height from floor line of 46 inches, and bed width across bedways of 40 inches. Swing over bed is 45 inches.

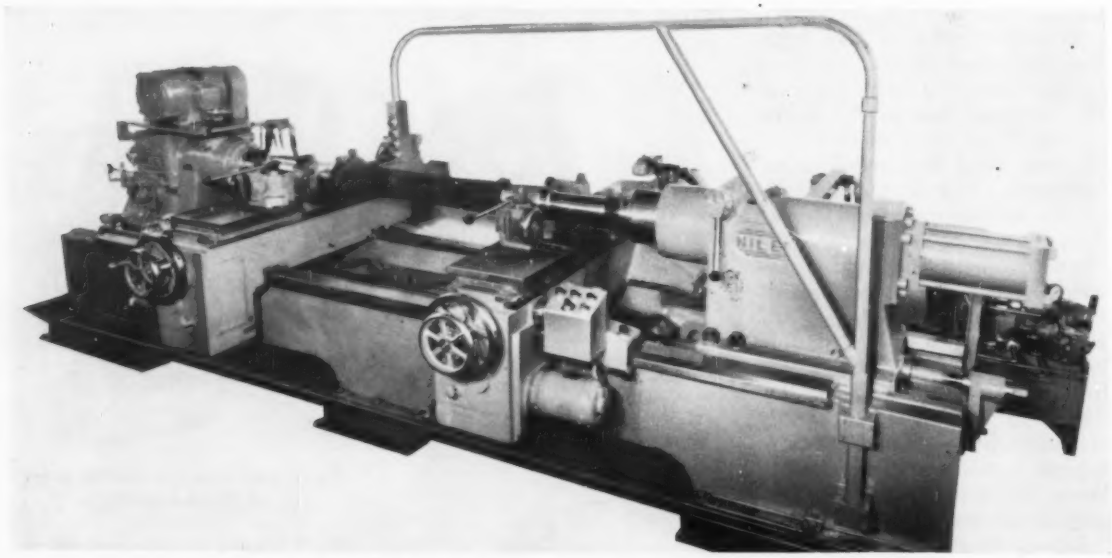
Circle Item 111 on postcard, page 161

Oliver contour-sawing machine

Contour-Sawing and Filing Machine

A contour-sawing and filing machine brought out by the Oliver Instrument Co., Adrian, Mich., is said to be so simple to operate that lapping, as well as sawing and filing, can be handled by an ordinary mechanic. With this machine, dies and tools can be shaped to the required dimensions quickly and accurately without hand-filing or other semifinishing operations. The machine is available in five types, in either a bench or pedestal model.

Circle Item 112 on postcard, page 161



High-production lathe for turning and burnishing railway-car wheels and axles

Fig. 1. Shear built by Cincinnati Shaper Co. for shearing electrolytic copper

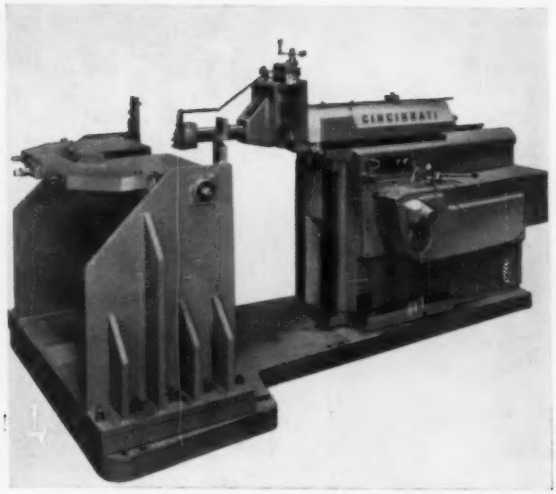


Fig. 2. Cincinnati shaper built to machine two surfaces at right angles to each other

Cincinnati Shear, Rigid Shaper and Press Brakes

The Cincinnati Shaper Co., Cincinnati, Ohio, has built three special machines of the types shown in the accompanying illustrations. The special 1004-RA shear, Fig. 1, was designed to shear electrolytic copper as part of an automatic cut-off line. The table height of 22 1/2 inches from the mounting pads matches other equipment.

This unit measures 4 feet 3 inches between housings and has a 6-inch gap. It has electric clutch control, and operates at sixty-five strokes per minute. The usual hold-down system and gages are omitted, since they are unnecessary. Machined openings in the table permit the installation of stock feeding equipment. Features include: automatic lubrication; accurate shearing with one knife clearance; and all-steel construction.

The 16-inch rigid shaper, Fig. 2, was designed to shape two surfaces, at an angle of 90 degrees to each other, in an irregularly shaped casting. The work-piece is held in a special two-station fixture mounted on the steel base of the shaper. The fixture replaces the table and rail assembly normally furnished on a machine of this type.

Because the work-piece is held stationary, the shaper is equipped with a special cross-travel head that permits cross-feeding of the tool. The extended tool-holder includes an automatic tool lifter. Assurance against wear is provided throughout the machine by a lubrication system operating at a pressure of 50 psi.

Two 9 Series Cincinnati press brakes, Fig. 3, each rated at 150 tons bending capacity, have been built to function as a single machine. They provide a 36-foot over-all die surface and have a throat clearance of 20 inches. The adjacent eccentric shafts of the two machines are equipped with a splined coupling which can easily be shifted to permit operation as one press, or separately as individual machines.

Limit switches are installed throughout to guard against damage to the machines, either when operating independently or as a unit. Both press brakes have two-speed transmissions that provide ram speeds of 7 1/2 or 30 strokes per minute.

Circle Item 113 on postcard, page 161

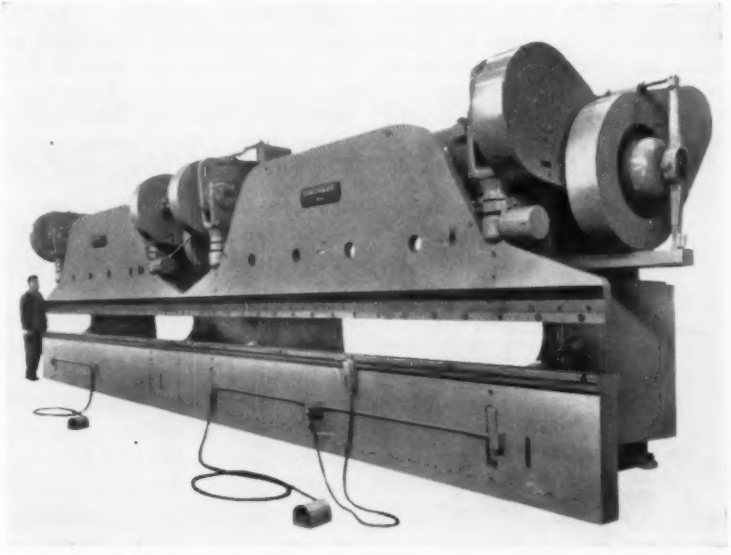


Fig. 3. Two Cincinnati press brakes built to function as a single machine

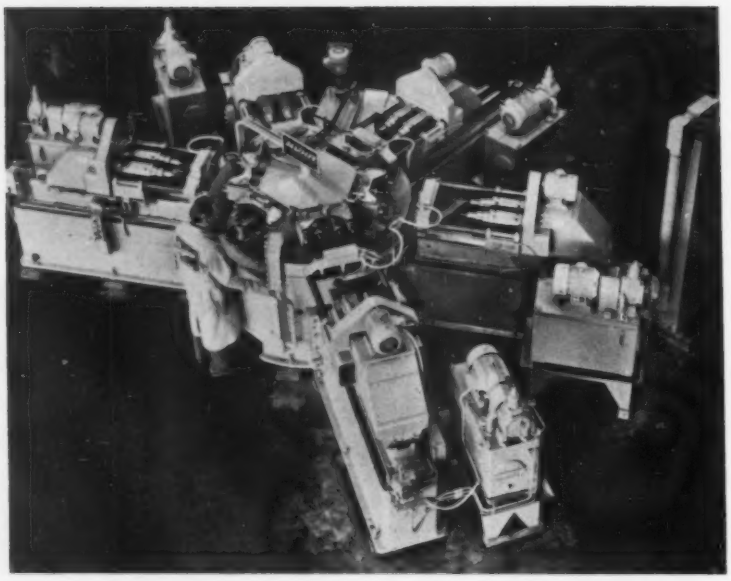


Fig. 1. Operator at load-unload station can control the five hydraulic-feed units of this Buhr Economatic developed for economical deep-hole drilling

Special Machine for Drilling Deep Holes in Automobile Steering-Gear Housing

A special automatic machine, Fig. 1, built by the Buhr Machine Tool Co., Ann Arbor, Mich., is designed to economically drill 1/4-inch holes 7 3/4 inches deep in automobile steering-gear housings. For this operation, it was more important to keep tool costs per piece down than to have a low machine cost. Twist drills, because of their reliability, low cost, and availability from stock, are used to drill the holes. The Buhr "Economatic" in which the twist drills are used was designed to minimize both drill breakage and the damage to work or machine that could result from it.

Because the 1/4-inch hole diameter is not critical—it is an oil passage—it was possible to reduce tool breakage by drilling the hole in five passes. Each pass adds to the depth of the hole but with a slightly smaller diameter. The last pass is made with a 1/4-inch drill and completes the hole to depth. By gradually decreasing the drill diameters in this way, rubbing was reduced and good clearing of the chips assured. For a hole having these dimensions, a single, long, 1/4-inch drill would have to be withdrawn several times during the drilling operation. Otherwise, rubbing and packed chips would cause high drill-breakage rates. The increase in the depth of the hole made by each of the five drilling steps was carefully computed so that the total cycle times for each pass would be the same. This made it possible to employ the most efficient infeed rates, cutting speeds, chip handling, and thrusts consistent with each drill diameter.

Five hydraulic feed units are arranged around an automatic six-position index-table, as shown in Fig. 1. Each feed unit carries two high-speed spindles for drills of the same size. Two work-pieces are hydraulically clamped in each of the six holding-fixture positions. Automatic cycles for each of the feed units include: rapid forward, feed, positive stop, and automatic reverse.

The long, slender drills are supported and guided by bushings during the drilling stroke. To prevent them from whipping and breaking during retraction and work-indexing, a second support bushing is located at the back of the bushing plate as shown in Fig. 2. Since it would be time-consuming and costly to probe holes for broken drills after each drilling step, the machine was equipped to continuously check the drill condition. A proximity-switch pick-up is located at a set distance from the drill and between the two bushings. When the drill is fully retracted, its point comes under the midpoint of this pick-up, as indicated in Fig. 2.

The metal of the drill provides a path for flux lines which initiate an electrical circuit. If the drill breaks, the circuit is broken and this amplified signal shuts down the machine. A red lamp glows to indicate which drill is broken. There is no chance for machine or work-piece damage because, when a drill breaks, a control relay in the "index" and "advance units" circuits opens to completely stop the machine cycle. Proximity control units are reset simply by replacing the broken drill. When the proximity-control circuit is again closed, the control relay automatically closes and the machine is again ready for operation.

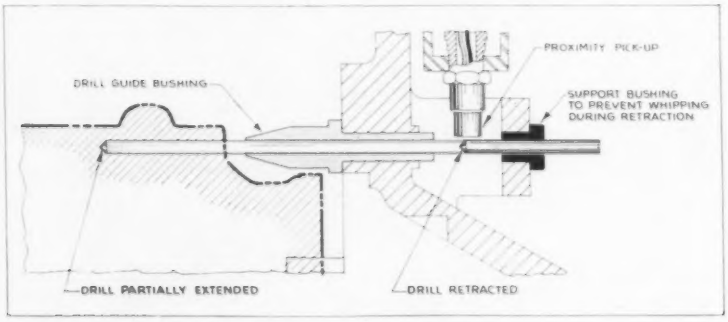


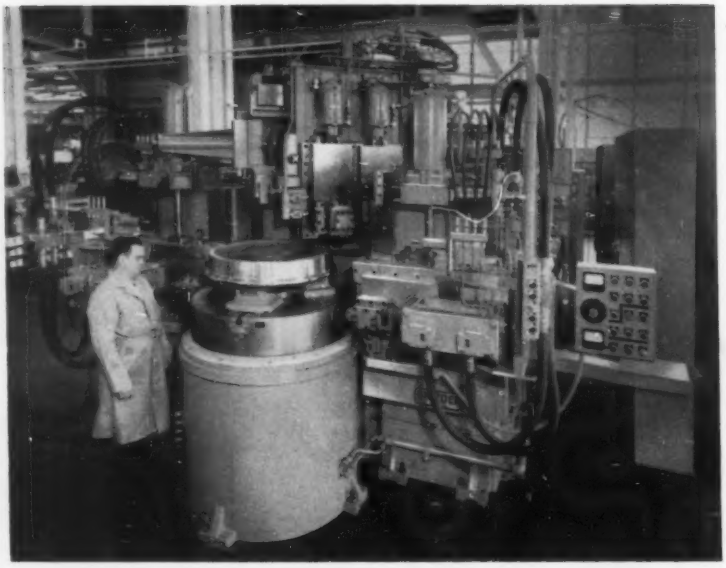
Fig. 2. Diagram showing special support bushing used to prevent whipping of long slender drills and pick-up safety device used in machine in Fig. 1

(This section continued on page 152)

Snyder Tracer-Controlled Lathe for Finish-Turning Railroad Car Wheels

A tracer-controlled special high-speed vertical lathe that finish-turns a variety of dished or rolled type railroad car wheels from the rough cast or forged condition has been built by Snyder Tool & Engineering Co., Detroit, Mich. This machine is designed to process wheels from 33 to 42 inches in diameter and weighing up to 800 pounds in a two-minute and fifteen-second machining cycle, using insert type carbide tools.

A 125-hp variable-speed drive provides the necessary adjustable 20- to 80-rpm table speeds. Unique hydraulic controls for the new machine include six pumps driven by one 15-hp and one 20-hp motor. The tracer system is operated by a template-controlled servo valve with a mechanical follower. The template can be changed to suit a variety of rim shapes. Hydraulic cylinders that operate a three-jaw chuck that grips the inside of the wheel rim, and an expanding arbor hold-down in the axle hole, secure the work on the table.



Snyder tracer-controlled lathe for finish-turning railroad car wheels

Circle Item 115 on postcard, page 161

Automatic Miller for Machining Turbine Blades

An automatic, hydrocopy blade-milling machine called the "Rigid ST-100" is being introduced in the United States by the Cosa Corporation, New York City. This machine is said to provide an improved method of milling jet-engine or gas and steam turbine blades with blade sections up to 16 inches in length. It is available as a two- or three-spindle machine, and is hydraulically controlled. Working accuracy is held to ±0.002 inch. The excellent finish obtained is said to reduce blade-polishing time to a minimum.

Turbine blade-milling machine introduced by the Cosa Corporation

The fully automatic machining-cycle control provides for automatic switch-over from pendulum milling along the shroud to fast sweep milling along the length of the blade. Sweep-milling feeds up to 40 inches per minute are possible. The feed rate remains constant over any profile up to angles of 80 degrees. An additional transverse copying device is provided which permits three-dimensional machining of blades with angular shrouds.

There are sixteen spindle speeds ranging from 24 to 420 rpm. Spindle drive is by a 10- to 12-hp motor. Hydraulically controlled, universal clamping devices hold the blades. Master blades can be used as models. A separate control panel contains the hydraulic unit which is equipped with thermostatically controlled, oil temperature and electrical control elements.

Circle Item 116 on postcard, page 161

(This section continued on page 154)

Landis Coupling-Tapping Machine

The Landis Machine Co., Waynesboro, Pa., has announced a 77TA automatic coupling-tapping machine designed for high-production, precision, internal threading of oil-tube and commercial couplings. It will handle work ranging from 2 7/8-inch externally upset drill-pipe up to 9 5/8-inch long-thread casing couplings. Because it is pneumatically operated and electrically controlled, only visual inspection and magazine loading of this machine is required by the operator.

Production tapping rates range from fifty-six 1/2-inch line-pipe couplings up to eleven 9 5/8-inch long-thread casing couplings. Also, standard merchant and many special couplings can be tapped at high-production rates.

Ten spindle speeds, ranging from 7 to 56.8 rpm, are obtainable by changing the V-belt drive pulleys when using an alternating-current, constant-speed motor. However, the machine can be supplied with either an alternating-current, mechanical type of variable-speed drive or a direct-current, variable-speed motor that provide adjustable spindle speeds ranging from 4.5 to 54 and 6.5 to 53.5 rpm, respectively.

Machine features include: a receding-chaser tap mechanism to assure threads of positive and precision taper with infinite settings from 3/4 inch to 0 taper per foot; detachable tap heads for wide-range coverage with minimum tooling cost; setup ease; lead-screw feed; precision worm and worm-wheel drive; integral spindle and tap unit for increased rigidity; and rugged compact construction for heavy-duty, high-production operations.

The machine has a variable spindle float to maintain perfect alignment between the tap and chucked coupling. Thrust type ball bearings permit freedom of movement which allows the float mechanism a 3/32-inch total compensating movement from the spindle's center line in any direction. Thus, when tapping couplings having normal differences in outside diameter, or concentricity of bore and outside diameter, alignment can be maintained and satisfactory threads produced.

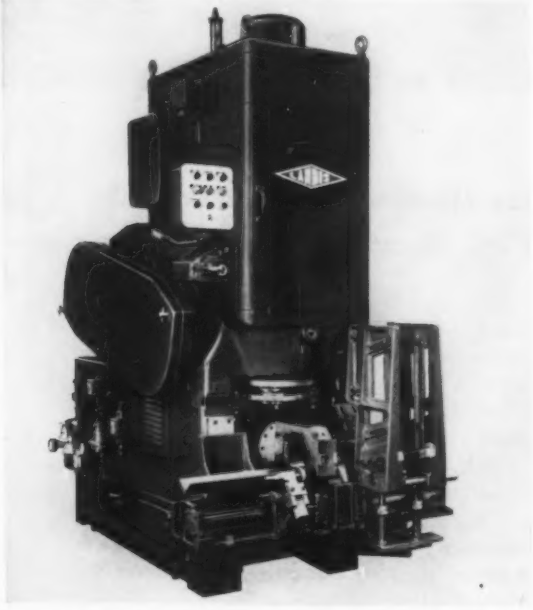
Circle Item 117 on postcard, page 161

"Optimount" Helical-Geared Speed Reducers

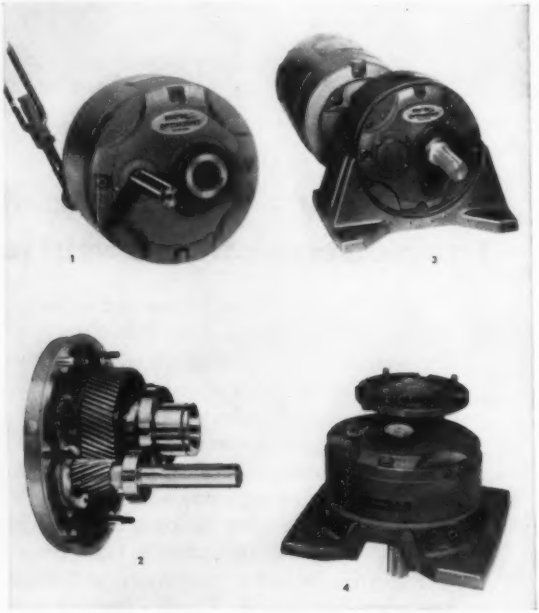
A line of "Optimount" helical-geared speed reducers, designed for easy adaptation to an unlimited variety of mounting positions, has been announced by the Boston Gear Works, Quincy, Mass. These speed reducers feature a basic unit with either single- or double-reduction helical gearing, which can be mounted directly on the driven shaft or in standard-stock horizontal- or vertical-shaft bases. Four sizes provide output speeds of 10 to 431 rpm and capacities of 1/6 to 15 hp.

The basic units are available in three types: Optimount Reductors designed for V-belt, sprocket, or gear drive to input shaft; Optimount Ratiomotors that provide direct motor drive to input shaft; and Optimount flanged Reductors, which are units sold without motors, ready for attachment to motors of the customer's choice.

Referring to the accompanying illustration, the view (1) in the upper left-hand corner shows the Optimount Reductor unit for shaft-mounting, equipped with the standard, stock adjustable-reaction rod which prevents rotation of the unit and provides for convenient adjustment of the in-



Automatic coupling-tapping machine announced by the Landis Machine Co.



Optimount speed-reducer units introduced by the Boston Gear Works

put drive. View (2) shows the helical gearing in a single-reduction unit. This same standard housing takes double-reduction gearing. The through-bored hollow output shaft permits unrestricted adaptability to mounting conditions. In view (3) is shown a horizontal base-mounted Optimount Ratiomotor. The gear unit can be rotated and reset in its base at any of four positions to suit the drive conditions. A vertical base-mounted flanged Reductor is shown in view (4).

Circle Item 118 on postcard, page 161

Gap Presses Equipped with Automatic Feeds

Series G1 single-point gap presses in capacities ranging from 75 through 250 tons, and equipped with feeds for automatic production, are being built by the Minster Machine Co., Minster, Ohio. Either single- or double-roll feed equipment can be supplied on the single-geared Series G1 presses which are available in both fixed-base and inclinable types. These presses have massive steel frames (a 200-ton G1 press weighs over 30 tons without feed) designed to achieve minimum deflection and the compressive strength needed to obtain the desired vibration-dampening capacity.

Electrical, air and recirculating-lubrication controls are mounted within the legs of the press. The compact, built-in design protects the controls and allows quick adjustment from a single point. All Minster G1 gap presses of this type are equipped with a combination air friction clutch and brake unit which makes possible accurately controlled single or multiple cycling.

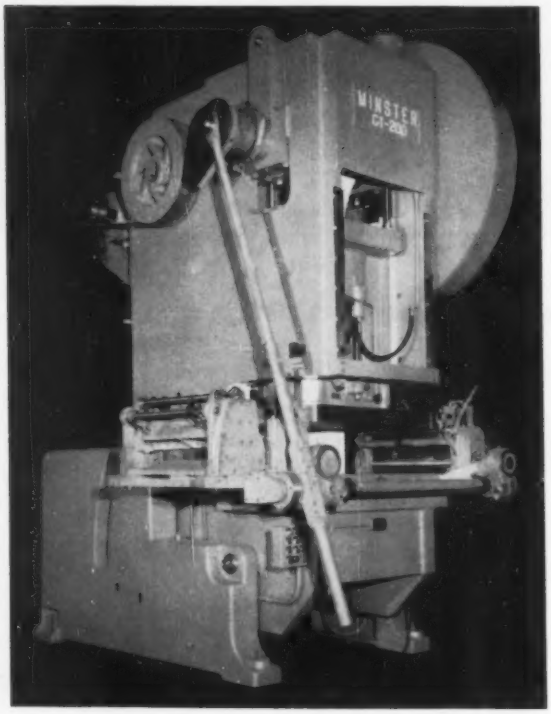
Circle Item 119 on postcard, page 161

Ty-Sa-Man Friction Saw

Development of a friction saw of entirely new design has been announced by the Ty-Sa-Man Machine Co., Knoxville, Tenn. The machine has an electronic feed and a unique coolant system developed to assure cool-edge, dry-blade cutting. The saw's one-piece construction permits it to be used as a semi-portable machine and eliminates the need for building a pit.

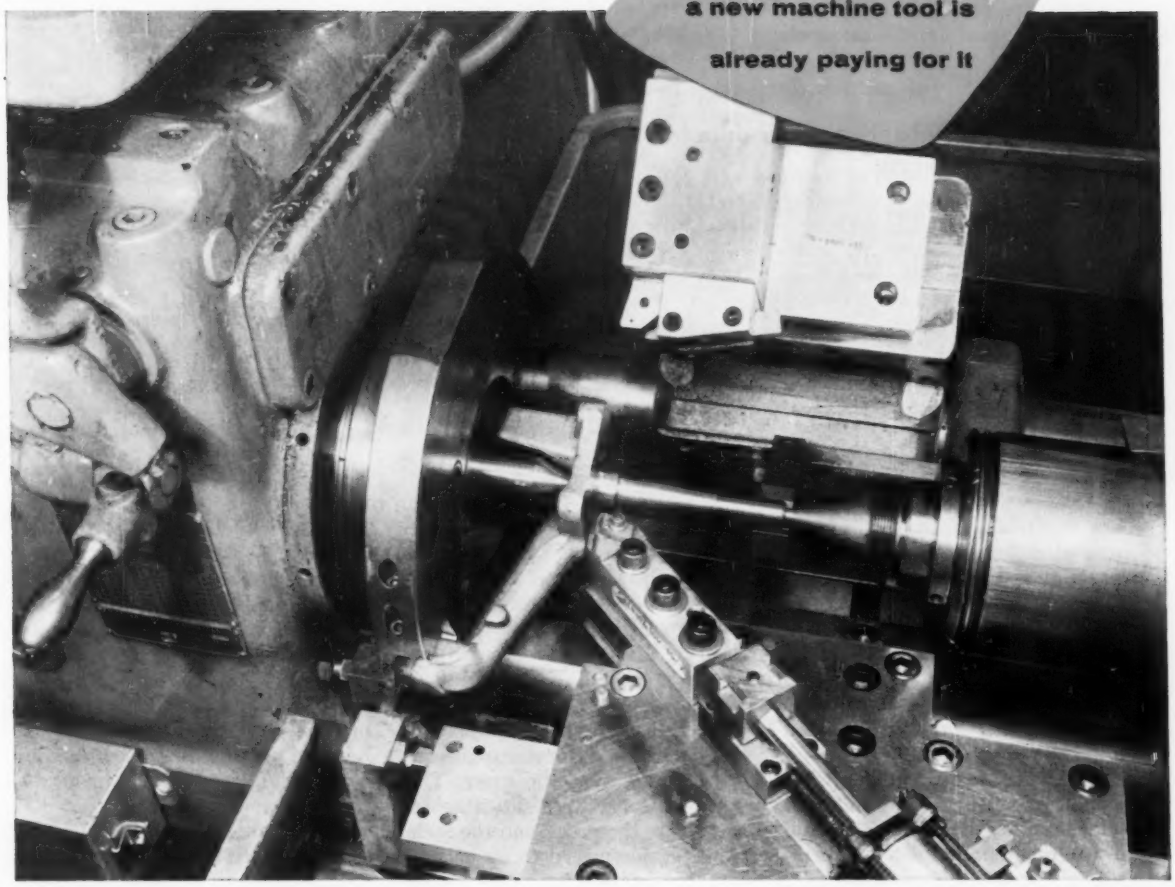
Models built in 40-, 75-, and 150-hp sizes have been used in three large steel plants where they were production-tested in cutting structurals, fabricated sections, rails, and pipe. Results indicate that the new coolant system reduces saw-changing time by over 50 per cent while prolonging blade life. The electronic, variable-torque feed is a completely self-contained unit with a built-in cooling system.

The high blade-edge speeds attained by this type of saw generate an air-flow barrier that partially repels coolant sprays. A powerful (15-hp) pump propels a stream of coolant water at high velocity under pressure of 140 pounds per square inch which penetrates the surrounding air barrier where the blade leaves the cut. This gives the edge time to cool and dry before it re-enters the cut. Thus, the coolant is prevented from entering the cut and lowering the temperature of the metal, an action which would be directly opposed to the principle on which friction sawing is based.



Minster 200-ton gap press equipped with automatic roll feed

Ty-Sa-Man high-speed metal-cutting friction saw



Tracing on Standard Fay Automatics extends tool life 100% – consistently holds tolerances to .004″ in one cut at high production

Profile turning combined with back-arm machining is now available on the rugged, high production Fay Automatic Lathe. The tracing unit is relatively inexpensive and can be installed in the field, as well as on new machines at the factory.

Recent tests on steering knuckles showed that a *single* cut with the back arm faced the flange square within .001″ at a surface speed of 585 F.P.M. The tracing unit, operating at 765 F.P.M., turned the entire contour of the stem up to the flange, while holding three diameters to .004″. The complete machining cycle was 40.5 seconds per piece.

Tool life, always an important cost factor on high production jobs, was excellent. Insert, throw-away carbide tooling was used. Whereas previously tool changes were necessary after every 60 pieces, this mechanical tracer holds size through 120 pieces. At that time the cutting edge of the tool is indexed and one simple adjustment reestablishes size.

For more detailed information on this interesting new development, write to Jones & Lamson Machine Company, 512 Clinton St., Springfield, Vermont.

The efficient operation of the saw is made possible by the specially designed guard which catches the coolant as it leaves the blade and returns it to the reservoir without letting it reach the cut. The guard also traps sparks and reduces the noise level.

A curtain of steel encloses the blade, except for the material opening. The operator's station is shielded on three sides by steel plate and has an unbreakable observation window, which affords close-up vision of the work. Controls are contained on a push-button panel.

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Bliss Moving Bolsters and Automatic Die-Clamping Device

Moving bolsters, such as shown in Fig. 1, automatic die-clamping devices like the one illustrated in Fig. 2, and provisions for automatic slide positioning have been developed by the E. W. Bliss Co., Canton, Ohio, to make die changing easier and faster, as well as safer and more accurate. The moving bolster arrangement is applicable to all types and sizes of presses. Each bolster assembly carries its own pressure pins and a plate to keep the pressure pins in place while the bolster is being moved either into or out of the press. The bolsters are self-powered, each assembly being actuated from the master control panel.

The bolster traverses on special tracks to a lowering mechanism built into the press bed which lowers and accurately positions the bolster assembly in the press. While this die is stamping out parts, another die is being secured to the other bolster which is outside of the press. To change dies, the bolster in the press is simply rolled out and the other rolled into position.

In the die-changing operation, the press slide is brought to the bottom of its stroke so that the punch is nested in the lower die. The selector switch in the master control panel is turned to "Die Set," and the "Unclamp" button which operates the die-clamping devices (Fig. 2) is pushed. This momentary contact initiates an automatic sequence of operations for unclamping the punch from the slide. When completely released, the cycle of operations is self-terminating, and an indicating light in the master control panel turns from green to red, indicating an unclamped condition.

The press slide is then run up by its adjusting mechanism to clear the top of the punch, and the bolster and complete die set are rolled out of the press. The other bolster with its die attached is run into the press, and the slide adjusted downward to its correct shut height position. The punch is securely locked to the slide by simply pressing the "clamp" button. When completely locked, the indicating light in the master control turns from red to green.

Dies, clamps, and press slide are protected from damage or breakage in the event of improper die positioning or improper clamping techniques by an override device which permits the die clamp to recede into a cavity in the face of the slide. Electrical interlocks prevent operation of the press unless all clamps are properly locked. The automatic die-clamping device is available in two different sizes.

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Drill-Head Mounting for Overhead Track

An accessory that permits the mounting of a 20-inch drill head on an overhead track is now available from the Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. This setup is useful in drilling panels, sheets, plates, or large work, such as the piece in the rotary jig shown in the illustration. It can be used for any other work that is difficult to move or where it is easier to drill a number of holes without moving the work. The spindle may be positioned over any point within 10 inches of either side of the track and anywhere along its length.

The accessory consists of a carriage and column which may be

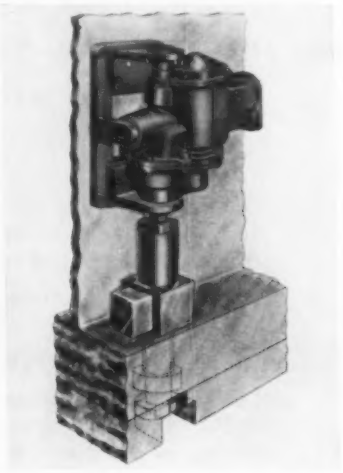


Fig. 1. (Left) Moving bolster plates developed by E. W. Bliss Co. to facilitate die changing. Fig. 2. (Right) Bliss die-clamping device

Delta drill head mounted on overhead track by means of recently announced accessory

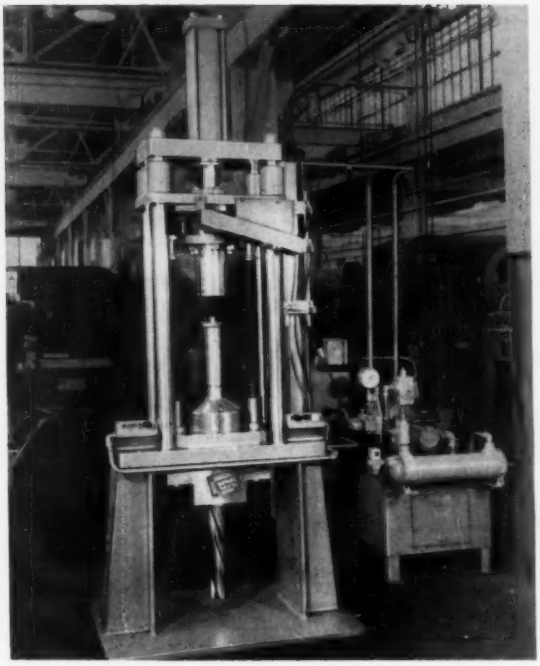


Fig. 1. Vertical hydraulic press equipped to broach teeth in cast-iron helical gear

mounted (with a standard 20-inch Delta drill head and its raising mechanism) on a jib crane or similar type track. The 3 3/4-inch diameter column is 33 inches long. Any of four Delta 20-inch drill heads may be used with the accessory.

Circle Item 122 on postcard, page 161

Red Ring Equipment for Broaching External Helical Gears

A Red Ring broaching process designed to produce external helical gears at an exceptionally fast rate has been developed by the National Broach & Machine Co., Detroit, Mich. In the initial application of the new process, a 20-ton vertical press, Fig. 1, is used to produce an 87-tooth, 24-pitch, cast-iron washing machine gear in a five-second cutting cycle. This gear has a helix angle of 22 degrees, an outside diameter of 4 inches, and a face width of 3/4 inch. The floor-to-floor time, including loading and unloading, is fifteen seconds.

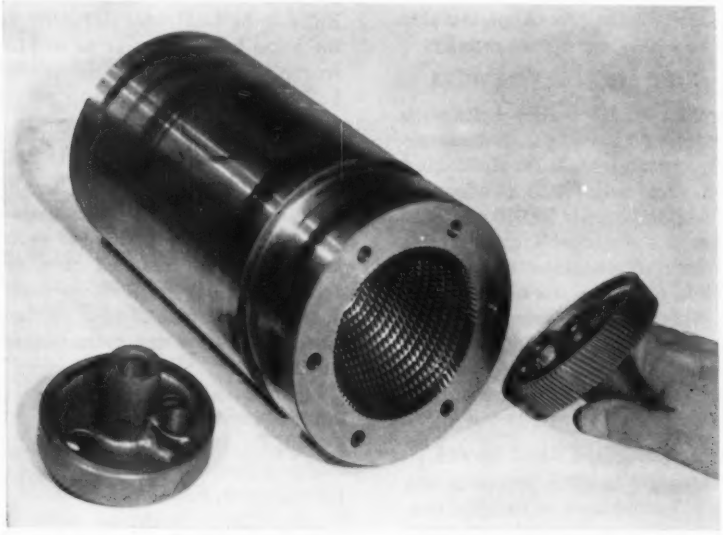


Fig. 2. Solid, high-speed steel hollow broach (center) used on machine illustrated in Fig. 1 to broach teeth of gear shown at right

The solid, high-speed steel hollow broach (center view Fig. 2), in which thousands of broach teeth are ground from the solid in an ultra-precision grinding operation, produces the teeth in the gear shown at the right in one downward stroke over a blank like the one shown at the left. In applying this process, the gear blank has to be rotated to produce the helical gear teeth while the broach is passed over it. Thus, the downward travel of the broach has to be accurately correlated with the rotation of the gear blank. The head supporting the broaching tool is geared up with the gear work fixture through a unique guide bar, crosshead, and helical lead-bar arrangement so that when the

(Continued on page 166)

R B&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Selecting the right grade of nuts

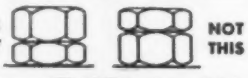
"Workhorse" among nuts is the standard "FINISHED" series. It gives good seating area; sufficient height to sustain high thread tension; enough wall thickness to control elastic nut dilation under load.

"HEAVY" nuts are wider than "Finished" nuts in *all* sizes by only ⅛" across flats. Thus, their value diminishes as size increases. Most effective in ½" to 1½" range, they satisfy applications involving excessive clearance holes, unusual loads, and certain boiler codes.

MATERIALS? The regular carbon nut steel (non heat treated). It makes nuts strong enough to pull bolts beyond yield point, lets threads distribute load to avoid stripping.

NUTS WITH "SPECIAL" FUNCTION

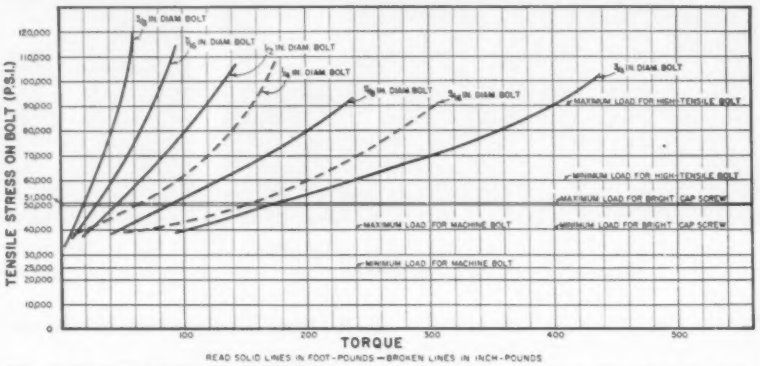
JAM NUTS are made for position locking. Use of two together forms a superior and economical locking device. When used to lock a regular nut, jam nut should be adjacent to work surface. Otherwise, the jam nut takes the load — a job it wasn't designed for.



Use a 2H NUT where high temperatures call for stability.

HIGH NUTS are used for shackle, U and tractor pad bolts. They're furnished only in fine threads, therefore, and hardened. More to be recommended are *coarse thread* finished nuts.

Tightening up fasteners tightens down on costs



These curves suggest torques for proper tightening of three grades of standard fasteners. Tightening to the upper limits delivers more of the holding power paid for, and assures stronger joints. Dropping below minimum values wastes fastener strength, invites loosening and failures. These curves are reproduced in RB&W Booklet DC-1.

It pays to go the limit in tightening bolts. Not only is it more economical, but safer too. For strength of a rigid connection depends on *residual tension* rather than on how strong the bolts are. Applying this fact can help avoid cost penalty.

EXAMPLE:

Blueprint specifies alloy bolts with strength of 145,000 psi. But assembly specification calls for tightening to what has been found an adequate pre-loading . . . only 30,000 psi. This wastes the fastener's capacity. It provides no more joint-strength than supplied by a *far more economical* RB&W bright cap screw tightened to same pre-load. It would be better to switch to the lower grade, or reduce size of the premium grade fastener.

REDUCING SIZE ALSO SAVES

A fastener's holding power is the same as its pre-load, or residual tension. So long as it permits tightening to the required pre-loading, the bolt can be small as possible.

EXAMPLE:

Design requires fasteners with safe load capacity of 20,000 lbs. Bright cap screws of ¾" size will do it; but so will ⅝" RB&W High Strength Bolts — *at less cost*. Actually, for the same holding power as in $1.00 worth of high tensile fasteners, $1.50 worth of bright cap screws are required.

PRODUCTION BENEFITS

Along with direct savings, smaller bolts mean smaller holes to drill or tap. Smaller holes often allow reduction in size of fastened members.

Talk to an RB&W fastener expert at the design stage of your product. He can help you cut costs without cutting joint strength.

Meanwhile, send for helpful booklet DC-1. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.

Plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

For more information fill in page number on Inquiry Card, on page 161

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

CAMS — Parker-Hartford Corporation, Hartford, Conn. Booklet giving information on 2D and 3D cams. It covers design and functions of two and three dimensional cams, their uses, and formulas. For your copy, please write on company letterhead to Parker-Hartford Corporation, 652 Franklin Ave., Hartford, Conn.

CUTTING TOOLS—Vascoloy-Ramet Corporation, Waukegan, Ill. 88-page catalogue presenting the complete line of V-R products for users of cutting tools. Included are: a grade chart explaining the fourteen grades of cemented carbide now available from V-R and their important physical properties; a new chart showing the user how to select his own grade of carbide for new applications plus recommended cutting speeds; and a new surface speed and tool selector chart. It is completely indexed. 1

AIR-OPERATED PUMPS — Lincoln Engineering Co., St. Louis, Mo. Two-color catalogue No. 65, covering design and engineering features for the complete series of Lincoln's sixty-seven new "Power-Master" pumps and allied equipment, including the "Dyna-Ram" air-operated pressure primer for pumping extra-heavy lubricants and "non-flowing" compounds, the Lincoln "Pile Driver," a maximum power air-operated pressure primer, and the super-volume "Niagara," pump designed to fit all of the new "Power-Master" air-motors. 2

METAL-CERAMICS—Haynes Stellite Co., New York City. Booklet presenting metal-ceramics and their advantages in the area of high-temperature service where most metals or ceramics alone cannot do the job. Typical parts made of metal ceramics are rocket-nozzle inserts, jet flame holders, thermocouple protection tubes, mechanical pump seals, furnace muffles, molten-metal control pins and spouts, and other parts for special service. 3

RECESSING TOOLS—Maxwell Industries, Inc., Ashtabula, Ohio. 16-page, two-color catalogue No. T-6, illustrating Maxwell's complete line of recessing tools, boring and reaming tools, grinding fixtures and arbors, torus-design, adjustable bore gages, "Mastur" lead-screw type boring heads, "E-Z Set" scroll type boring heads, boring and facing heads. Also covered are Maxwell's forged boring bits, boring-bars, and a variety of special tools. 4

HYDRAULIC CYLINDERS—The Sheffer Corporation, Cincinnati, Ohio. Bulletin No. 1258, presenting a line of space-saving square-head, super-duty hydraulic cylinders, 3000 to 5000 psi, for "extra-tough" applications. New Series C5H cylinders feature Sheffer-pioneered tapered cushions for gradual deceleration and minimum cushion entrance shock, double-seal piston-rings to minimize gap flow, and multiple-lip rod packing removable without disassembly. 5

COUPLINGS — Snap-Tite, Inc., Union City, Pa. Catalogue describing the company's standard line of quick-connect, quick-disconnect couplings. The five basic Snap-Tite couplings shown include the "H" coupling for high-pressure applications; the "IH" coupling for impact in air lines; the "Hi-Flow" coupling for low-pressure applications; the "E" coupling for vacuum and very low pressure; and the "T" coupling for hard to handle fluids. 6

FLEXIBLE COUPLINGS—T. B. Wood's Sons Co., Chambersburg, Pa. Bulletin No. 10100A, covering new additions to the line of "Sure-Flex" couplings, which now includes ten sizes. The additions are: No. 3 (3/8 to 3/4 inch bore), No. 4 (1/2 to 1 inch bore), No. 11 (1 7/8 to 2 5/8 inch bore) and No. 12 (2 3/8 to 2 7/8 inch

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bore). Selection data and other engineering tables have been revised to include these large and small coupling sizes. . .7

FLAME-CUTTING AID—Linde Co., Division of Union Carbide Corporation, New York City. Folder, Form 1057, describing several ways in which quality nozzle construction and proper nozzle selection can reduce gas consumption and nozzle replacement, which are primary cost factors in all flame-cutting operations. The advantages of chromium-plating and swaged construction are also described. 8

SPACERS—O K Tool Co., Milford, New Hampshire. Circular presenting a micrometric, adjustable arbor spacer that reduces setup time as much as seventy-five per cent by eliminating the old costly trial-and-error methods. This new device enables cutters, collars and spacers to be assembled to the desired widths, plus or minus tenths, with infinite adjustment of the dial. 9

CAP-SCREWS—Standard Pressed Steel Co., Jenkintown, Penna. Bulletin illustrating new design, socket-head capscrews delivering up to 2 1/3 times the load-carrying capacity of their conventional counterparts. Secret of the greater strength of the new "Unbrako pHd" (proper head design) fasteners, according to the company, lies in larger diameter heads. 10

HYDRAULIC EQUIPMENT—Elmes Engineering Division, American Steel Foundries, Cincinnati, Ohio. Bulletin 5200-A, covering complete line of Elmes hydraulic presses and equipment for the plastics and rubber-molding industries. It illustrates and gives description and principal specifications of Elmes compression and transfer molding presses, air-operated Hydrolair presses, as well as hobbing and laboratory presses. 11

PAINT STRIPPING—Oakite Products, Inc., New York City. Booklet F 7893R6, describing twelve different paint stripping compounds—alkaline, solvent, and solvent-acid—each designed to remove different type paints, and four methods of paint stripping. It then discusses the Oakite "Hot-Flow-On" method of stripping, consisting of flowing stripping solution through a perforated pipe rake or shower-head. 12

COUPLING TAPPING MACHINES—Landis Machine Co., Waynesboro, Pa. Bulletin No. E-98-1, describing the Landis 77TA automatic coupling tapper. It is designed for the automatic, high-production, precision tapping of large diameter, oil tubular and many other couplings ranging from 2 7/8-inch drill-pipe external upset to 9 5/8-inch long-thread casing couplings. 13

INVESTMENT CASTING—Haynes Stellite Co. A Division of Union Carbide & Carbon Corporation, Kokomo, Ind. 40-page catalogue presenting Haynes' method of mass-producing cast-metal parts. Table of contents covers: "Design and Tooling Services," "Special Finishing Facilities," and numerous items on Haynes stainless, low-alloy, and carbon steels. 14

ECCENTRIC GEARED PRESSES—Niagara Machine & Tool Works, Buffalo, N. Y. 43-page bulletin No. 66-A, presenting one-point, two-point, and four-point suspension types of eccentric geared presses for large, heavy-tonnage drawing, punching, and blanking work. It describes outstanding features, such as its crankless eccentric drive, pneumatic friction clutch, and air-releasing brake. 15

POLISHING MACHINES—Acme Mfg. Co., Detroit, Mich. 16-page, two-color, illustrated catalogue describing the straight-line type of automatic polishing and buffing machine. Six types of standard adjustable lathes that can be used in conjunction with straight-line polishing machines are described. 16

ROTARY SLITTING LINES—The Yoder Co., Cleveland, Ohio. 76-page, illustrated handbook covering the design, selection, and operation of slitters and slitting lines. Time studies, analysis of operating cycles, methods of coil handling, scrap disposal, and other operating data are included. 17

CONTROL UNIT—The De Silvey Corporation, East Aurora, N. Y. Catalogue discussing De Silvey "Director" (patents applied for), a control unit which performs automatically all turret-lathe functions heretofore done by hand. It allows the turret lathe to be operated three ways—fully automatic, semi-automatic, or completely manual. 18

ARC-WELDING TITANIUM—Mallory-Sharon Metals Corporation, Niles, Ohio. Brochure discussing the method and techniques used in arc-welding titanium. It lists the various commercially pure titanium grades and titanium alloys which can be arc-welded. Basic problems in handling these materials are discussed. 19

HAND SCREW MACHINE—Rockwell Mfg. Co., Delta Power Tool Division, Pittsburgh, Pa. Bulletin describing the recently introduced Delta hand screw machine. It includes a catalogue listing, complete specifications, and a description of how to convert a standard lathe to a hand screw machine. 20

THROW-AWAY INSERTS—Firth Sterling, Inc., Pittsburgh, Pa. Data sheet showing both the triangular and square high-speed throw-away inserts stocked in two grades—Circle "C" and Van Chip. These inserts are particularly adaptable for difficult high-temperature alloy turning applications. 21

THREADING HEADS—Landis Machine Co., Waynesboro, Pa. Bulletin F-80-7, illustrating and describing the Landis line of hardened and ground die-heads. It also

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contains detailed information concerning the design and operating features, including specifications. **22**

SPEED REDUCERS—Westinghouse Electric Corporation, Pittsburgh, Pa. Booklet B-7238, "Shaft-Mounted Speed Reducers," discussing selection, horsepower ratings, dimensions, construction, installation, and maintenance for the new Westinghouse "Moduline" shaft-mounted speed-reducing units. **23**

BAND SAWS—Johnson Mfg. Corporation, Albion, Mich. 8-page catalogue describing all Johnson metal-cutting band saws. It contains complete detailed information, specifications, as well as in-use photographs of all Johnson saw models, and stock stands and accessories. **24**

CONTROL VALVES—Parker Hydraulics Division, Parker-Hannifin Corporation, Cleveland, Ohio. Catalogue 1553A50, featuring Parker VDSP5 series, 65GPM hydraulic directional control valves having nominal rating of 65 gallons per minute. Series includes one-spool, two-spool, and three-spool models. **25**

SPOT-WELDER—Taylor-Winfield Corporation, Warren, Ohio. Bulletin 2-013A, describing the corporation's line of EB-1 air- or foot-operated bench-mounted spot-welders. The units are specifically designed for joining small parts of unusual metal combinations of precise shapes and sizes. **26**

WORK-HOLDERS—De Witt Equipment Corporation, Newark, N. J. Catalogue featuring DTC and Burnerd work-holding devices. It lists a complete range of work-holders from adapters through vises, including angle tables, arbors, chucks, and magnetic chucks. **27**

TANGENT BENDING MACHINES—Taylor-Winfield Corporation, Warren, Ohio. Bulletin 13-093, introducing a new line of air-operated tangent bending machines designed specifically to meet a need for inexpensive, rapid, light-duty metal-forming equipment. **28**

GRINDING MACHINES — Thompson Grinder Co., Springfield, Ohio. Catalogue T558, describing the Types B and C Thompson "Truforming" grinders. Drawings illustrate how Truforming works. Eight case histories of typical jobs accomplished by this process are included. **29**

GRINDERS—Landis Tool Co., Waynesboro, Penna. 20-page catalogue B-571, featuring the company's 10-inch CH and 14-inch LCH plain hydraulic cylindrical grinders. It includes complete specifications and illustrates work setups that can be done on this machine. **30**

COOLANT BACTERICIDE-DEODORANT—Cincinnati Milling Machine Co., Products Division, Cincinnati, Ohio. Brochure describing "Cimcool Bactericide '00' Wafers." It outlines the features of this new bactericide which protects against rancid cutting fluids. **31**

CLAMPING TOOLS—Wilton Tool Mfg. Co., Inc., Schiller Park, Ill. Catalogue No. 114, presenting a line of clamping tools, with applications, construction, and specifications on over 400 items. It has a color-coded index. **32**

GAGING FIXTURES—Wm. L. Riggs Co., Tulsa, Okla. Booklet presenting "Econo-Check," which is a type of gaging fixture for comparative measurement of machine parts. It describes various models. . . **33**

DIE-CASTING MACHINES—Lake Erie Machinery Corporation, Buffalo, N. Y. Bulletin 23.10, presenting a line of toggle type die-casting machines. This line of equipment, in sizes from 650- to 2000-ton clamping capacity, complements company's wedge cam toggle machines. . . **34**

TITANIUM MACHINING — Mallory-Sharon Metals Corporation, Niles, Ohio. Brochure, "Machining Recommendations for Titanium," discussing the fundamentals of machining titanium, the factors which affect machinability, and the basic requirements necessary. **35**

ELEVATOR HOPPER—U. S. Engineering Co., Long Island City, N. Y. Brochure B-34, describing an elevator hopper. It can be used for such items as gear blanks, cylinders, bushings, etc. **36**

TUBE CUTTER—Steel Products Engineering Co., Division of Kelsey-Hayes Co., Springfield, Ohio. Pamphlet presenting the Brehm tube cutter. No burrs result, it is entirely automatic, and it has a great range of cutting thicknesses. **37**

BAND SAWS—L. S. Starrett Co., Athol, Mass. Bulletin No. 1069, describing Starrett "Safe-Flex" high-speed steel band saws. It gives recommendations for use and specifications covering the blade sizes and pitches available in hook-tooth, regular, and skip-tooth types. **38**

HYDRAULIC PRESSES—A. B. Farquhar Division, Oliver Corporation, York, Pa.

Bulletin H-5000, illustrating the company's full line of four-column type hydraulic presses. Construction facts, data on types of controls, pumps, and cushions available are all included. 39

GROOVING TOOLS—Acme Grooving Tool Co., Detroit, Mich. Folder providing quick visual guide to typical grooving and cut-off tools, illustrating the "Mirro-Lap" finish and supplying data on finishes, tolerances, types of tools, and tool materials. 40

DRILL PRESS VISE—L-W Chuck Co., Toledo, Ohio. Brochure featuring the "Adjusto-Quick" drill-press vise and other metalworking tools, including lathe chucks, dividing heads, milling machine vises and magnetic chucks, demagnetizers, and rectifiers. 41

DIAMOND WHEELS AND HONES—Simonds Abrasive Co., Philadelphia, Pa. Booklet describing a line of diamond grinding wheels, featuring man-made diamonds, especially for grinding cemented carbide tools. Specifications and other applications are given. 42

WELDING TECHNIQUES — Titanium Metals Corporation of America, New York City. 32-page handbook No. 6, covering in detail fusion-welding equipment and procedures, resistance-welding equipment and procedures, a study of typical weldments, and methods for evaluating weld quality. 43

WEATHER-PROTECTED MOTORS—General Electric Co., Schenectady, N. Y. four-color bulletin GEA-6721, illustrating General Electric's new weather-protected motors, available from 250 hp and up for both indoor and outdoor operation. 44

ROLLER BEARINGS—Sonnet Tool & Mfg. Co., Hawthorne, Calif. Bulletin covering Sonnet roller bearings for milling-machine outboard supports. It lists bearing sizes and dimensions for popular-make milling machines. 45

VERTICAL PROFILER—Pratt & Whitney Co., Inc., West Hartford, Conn. Brochure presenting a new concept in tracer control for automatic, 360-degree profiling with P & W "Magnespark" vertical profiler. Specifications are given. 46

DRILLING AND TAPPING UNITS—Hypneumat Inc., Milwaukee, Wis. Bulletin No. 5810, featuring automatic "Hy Pneu Mat" drilling and tapping units, air- or hydraulic-powered. Specifications are given. 47

HONING MACHINES—Superior Hone Corporation, Elkhart, Ind. 30-page catalogue featuring four honing machines and two honing heads which are adaptable to drill presses, mandrel driver, mandrels, and abrasive stones. 48

LATHE TRACER ATTACHMENT—True-Trace Sales Corporation, El Monte, Calif. Bulletin No. LTA-1, giving features and applications of single-dimension, 45-degree lathe tracer attachments. 49

HYDRAULIC CYLINDERS—Hanna Engineering Works, Chicago, Ill. Catalogue 900, listing features of "Powrdraulic" hydraulic cylinders. It includes specifications and diagrams. 50

CARTRIDGE BALL BEARINGS—Hoover Ball & Bearing Co., Ann Arbor, Mich. Circular outlining specifications of dual labyrinth seals which assure long bearing life and lasting protection. 51

CUT-OFF TOOLS—Portage Double-Quick, Inc., Akron, Ohio. Circular illustrating Manchester inserted-carbide cut-off and grooving tools. A chart with specifications is provided. 52

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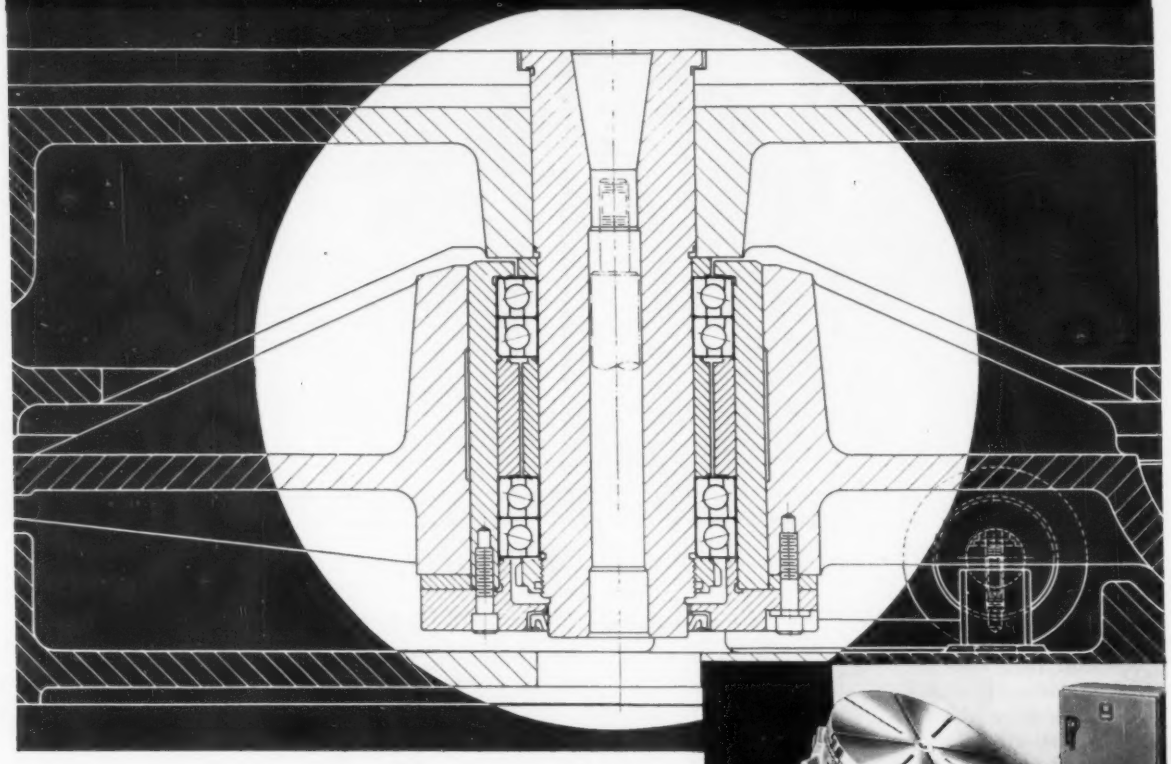
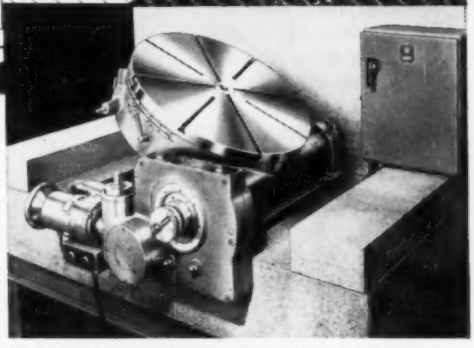
1½-ton rotary table held accurate to seconds of arc!





Pratt & Whitney 36" Precision Tilting Rotary Table is designed for large jobs requiring precise circular spacing and angular positioning. It is completely powered . . . makes possible several machining or inspection operations with a single setup . . . permits direct rotary vernier readings to two seconds of arc over a 360° range and tilting vernier readings to one minute of arc over a 90° range, with a sine bar arrangement for setting table tilt accurately to seconds.

PRATT & WHITNEY
equips for precision with
FAFNIR BALL BEARINGS

The extreme accuracy designed into Pratt & Whitney's 36" Tilting Rotary Table puts a heavy premium on bearing performance. For the critical central pivot application, Fafnir super-precision ball bearings are specified.

Here are bearings with the capacity and rigidity to hold a ton-and-a-half table at *seconds of arc* accuracy — and maintain this precision under large-job work loads.

It takes plenty of bearing to deliver performance like that! Yet the application is typical of many in Fafnir's files. Fafnir's "experience in precision" can help *you* solve a bearing problem. Write The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

Fafnir Super-Precision Ball Bearings, counterbore construction, support the central pivot of the table component in Pratt & Whitney's 36" Tilting Rotary Table. Mounted in tandem duplex pairs, they provide the exceptional rigidity necessary for this precision application.

Fig. 1. Jones & Lamson 14-inch optical comparator

Fig. 2. Model FC-30ER extended range J & L comparator

broach advances down over the work, the work is turned by the lead bar. The lead bar has two precision helical flutes that engage internal tooth members in a fixed guide bushing in the cross-head member.

After the broach has passed over the work gear, it ascends to its initial position, carrying the gear with it. At the top of the stroke, an air cylinder ejects the finish-broached part to a position at the front of the broach head, where it is placed in an ejection chute. Both bronze and plastic gear blanks of the same size as the cast-iron gear have been broached with the same tool to provide smooth, accurate, gear-tooth surfaces.

Extremely accurate gear teeth are produced by the new process. A check of ten gears produced by the broach showed maximum tooth-pin size variations of only 0.0009 inch, a maximum variation in lead on both sides of the teeth of 0.0008 inch, and a maximum involute variation of 0.0003 inch. When run with a master gear on a rolling fixture, a total indicator reading of runout was less than 0.001 inch.

Circle Item 123 on postcard, page 161

Jones & Lamson Optical Section Comparators

A 14-inch optical section comparator, Fig. 1, for inspecting edge-contour sections has been developed by the Jones & Lamson Machine Co., Springfield, Vt. This comparator can be used to inspect the contours of blade edges and the fairing between the edge contour and the foil contour. It incorporates two high-intensity illuminating units which produce collimated light. These are mounted on the hood of the machine. The manually operated blade-orienting fixture has an adjustable locating vee and built-in knife edge.

The collimated light is projected past the knife edge onto the blade held in the locating vee. The straight-line shadow thus formed is inspected, on the viewing screen, as a cross-sectional view of the blade-edge contour. By moving the blade to and from the lens, the edge contour may be inspected along the entire blade.

Inspection of full sections of objects such as turbine blades, gears, splines, etc., is possible on any J & L 20-inch comparator with a new sectioning attachment which will soon be available.

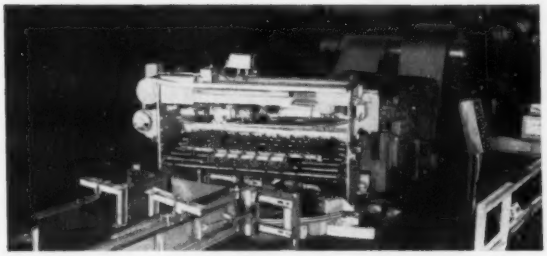
The Model FC-30ER extended-range optical comparator, Fig. 2, designed to fill a long-standing need for a standard machine that will accurately inspect extra-large, heavy parts has a measuring area of 80 square inches. Up to 10 inches of lateral measurement is provided—with a ruggedly engineered, roller-mounted, heavy-duty table. Accurate vertical measurement up to 8 inches is permitted through the new double-spindle table support. The 8- by 32-inch heavy-duty table provides sufficient rigidity for measuring of heavy objects weighing 200 pounds and more.

It is possible to project over and under objects up to 8 inches in diameter without interference with either the lens or viewing screen. Accurate setting of the shadow to the chart lines is assured, since the "total" screen area is easily accessible to the operator. The comparator is properly hooded and provided with curtains so that the operator can control screen contrast regardless of surrounding light conditions.

Circle Item 124 on postcard, page 161

(This section continued on page 168)

Cincinnati Shear swivels for mitre cuts at Budd



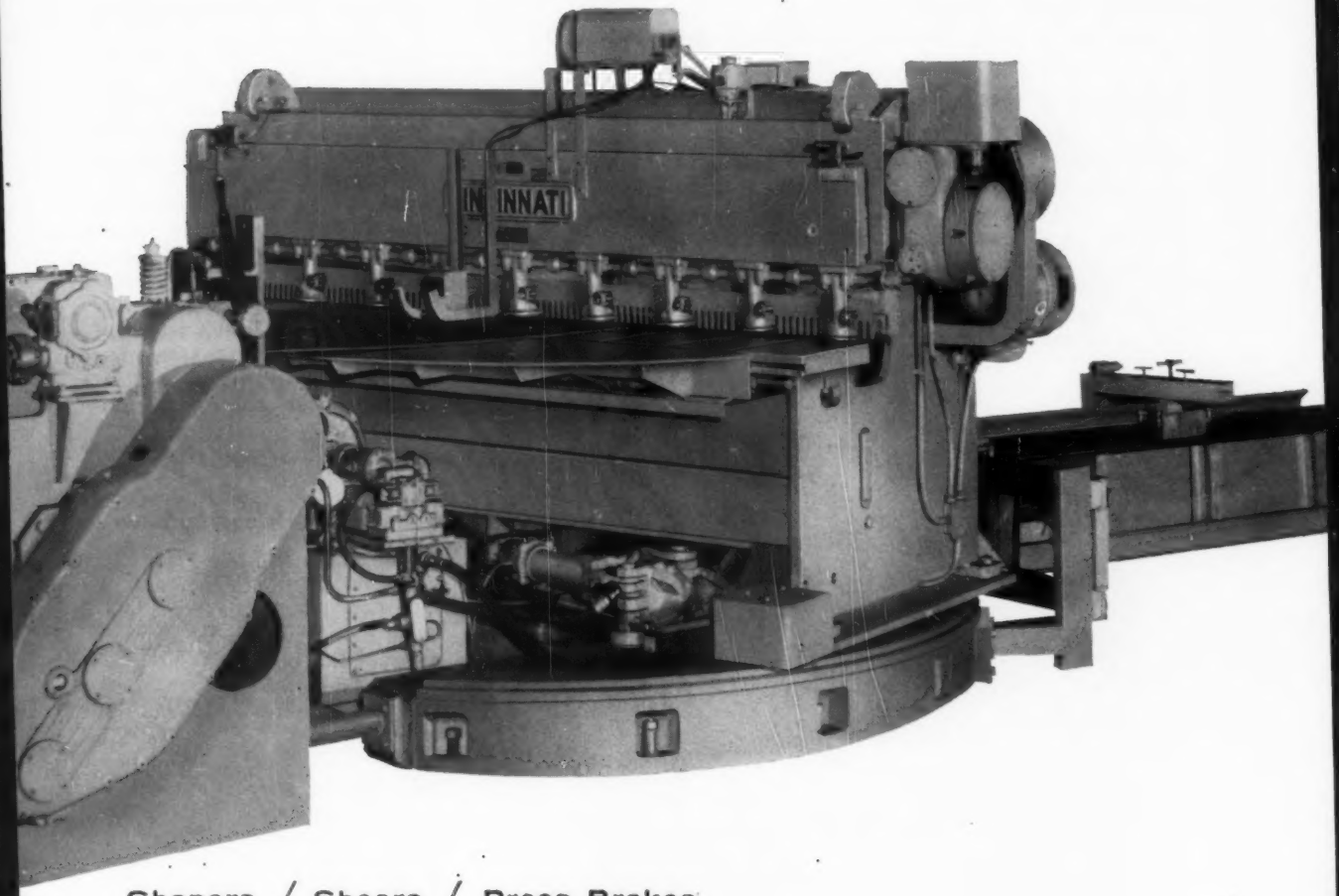
This Cincinnati Shear is an integral part of an automatic decoil and shear line at The Budd Company's Gary, Ind., plant. It is used for straight and mitre shearing of coil stock into sheets.

Mounted on a swiveling base, the shear can be rotated 22½° to either side of center, so the operator can pre-set the desired angle of cut.

Accuracy must be within ⅛" per 80" of feed. Sheet widths range from 24" to 72" and thickness from 21 to 16 gauge (.0349" to .0625"). Since the operation must be automatic and continuous to be economical, Cincinnati dependability is a vital asset.

This shear was specially engineered for The Budd Company. However, most of its profitable features are available with standard Cincinnati Shears. They include powerful hydraulic hold-downs, all-steel interlocked construction, and one-clearance shearing of different metal thicknesses.

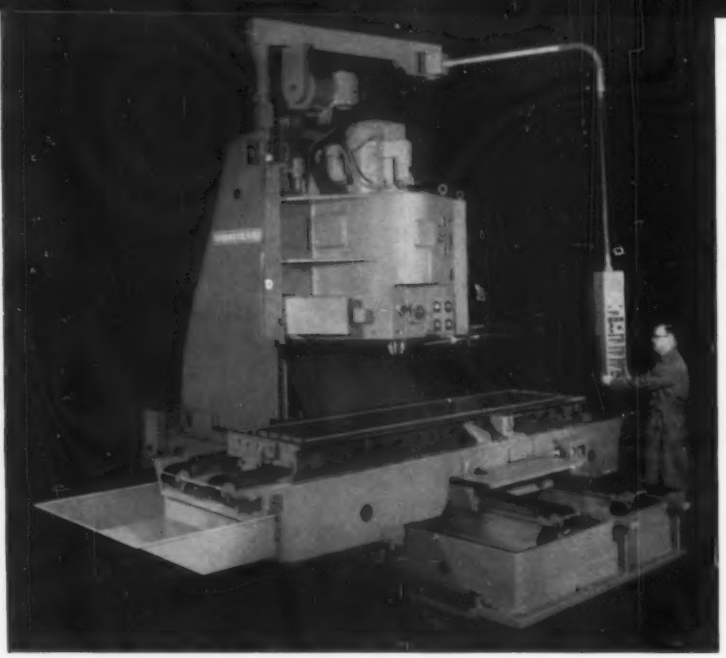
Complete details on Cincinnati All-Steel Shears are included in Catalog S-7R. Write to Dept.D.



Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.



Vertical Rigidmil with three-directional feed announced by the Sundstrand Machine Tool Co.

Sundstrand Vertical Rigidmil with Three-Directional Feed

The Sundstrand Machine Tool Co., Rockford, Ill., is presenting an OM5 vertical Rigidmil designed for heavy cuts on large work-pieces. This milling machine has longitudinal, transverse, and vertical feeds. It is equipped with a 50-hp, vertical head mounted on a fixed column, and has the saddle and table mounted on a fixed base. This base eliminates overhang deflection during heavy cuts, assures maximum support under the cutter, and provides a fixed table height.

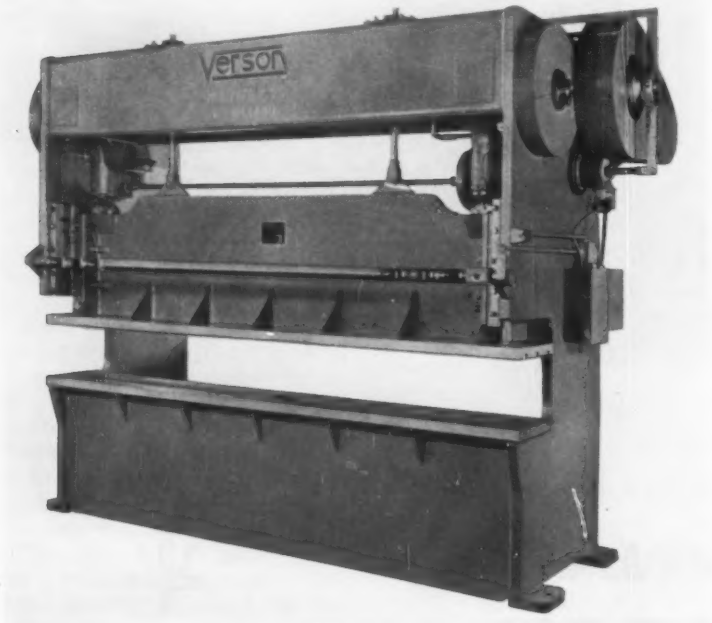
The vertical spindle has a speed range of 14 to 1540 rpm with speeds selected from the control pendant. The head is capable of transmitting 1 hp per rpm up to the maximum rated horsepower. A swinging pendant, adjustable to any operating position around the machine, provides quick push-button control for all functions.

Vertical travel of the head is infinitely variable within a feed range of 3/16 inch to 50 inches per minute in either direction. The rapid traverse rate in either direction is 50 inches per minute. The distance from the top of the table to the face of the spindle nose ranges from 6 to 30 inches.

Transverse travel of the saddle is infinitely variable within the feed range of 3/8 inch to 75 inches per minute in either direction. Rapid traverse rate in either direction is 75 inches per minute. The distances from center line of spindle head to face of column range from 16 to 60 inches.

Longitudinal table travel is infinitely variable within a range of 3/8 inch to 150 inches per minute and for either direction. The rapid traverse rate is 150 inches per minute. The table is 30 inches wide, 132 inches long, and has a travel range of 96 inches. Meters for all three feeding movements indicate rate of feed selected at pendant. A power draw-rod, operated from the pendant to facilitate cutter removal, can be provided.

Circle Item 125 on postcard, page 161



Verson gang-punching machine

Gang-Punching Machine

The Verson Allsteel Press Co., Chicago, Ill., has announced a new type of gang-punching machine that features light tonnage and a large bed and ram area. This press has a capacity of 60 tons and measures 126 inches between housings.

The new model is equipped with electric push-button clutch control, automatic lubricating system, and air counterbalance for the ram. The stroke and power-driven ram adjustment are each 4 inches. The shut height from bed to ram is 14 inches; and the area of bed and ram, front-to-back and right-to-left is 20 by 132 inches. The operating speed is forty-five strokes per minute.

Circle Item 126 on postcard, page 161

Automatic Flash-Welder

A line of automatic flash-welders, including the 400 KVA-F5 machine shown in the illustration, is now being marketed by the Federal Machine & Welder Co., Warren, Ohio. The machine shown is equipped for flash-welding hot-rolled steel rings 3/8 inch thick up to 8 inches wide, and can also be used for welding flat stock. Air-operated, alligator type clamps provide the gripping power required to hold the work. A work-upsetting force of approximately 38,000 pounds is provided by a double-acting hydraulic cylinder. The hydraulic unit includes an electrical control panel with all necessary relays and timers for controlling the various functions of the hydraulic unit. Clamping, flashing, upsetting, interruption of welding power, unclamping, and platen return are also controlled by the same panel.

The welding-power interruption, the upset travel, the hold time on the clamp after completion of weld, the hold time after clamp release, the flashing cycle and the flashing curve are all adjustable and calibrated, making duplication of a setup very simple.

Circle Item 127 on postcard, page 161

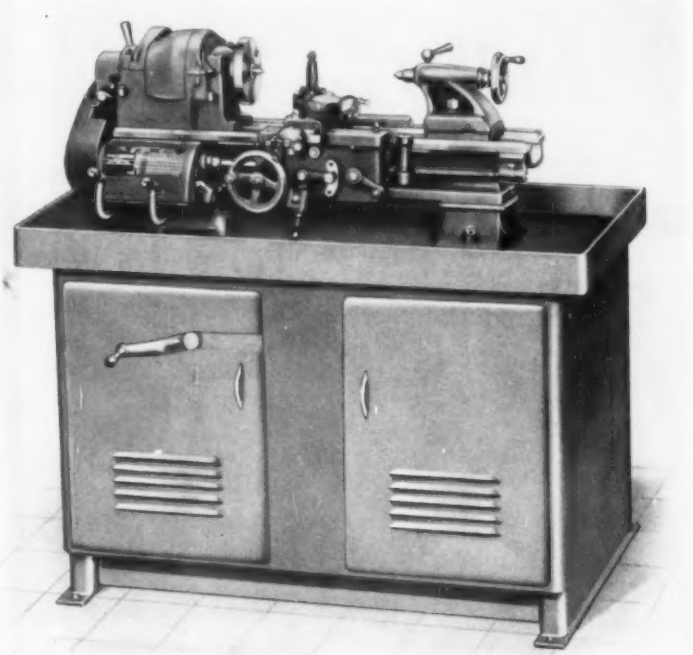
Federal automatic flash-welder equipped to weld hot-rolled steel rings

South Bend Precision Lathes

An improved line of 10-inch swing, precision lathes is announced by the South Bend Lathe Works, South Bend, Ind. New design features have been incorporated in the gear-box, carriage, bed, and tailstock to provide greater accuracy, durability and operating convenience. Both bench and floor models are made in several bed lengths and are supplied with either engine lathe or toolroom lathe equipment.

The thread-cutting range has been increased to seventy pitches —4 to 480 threads per inch, including all standard pitches from 4 to 80 as listed in National Bureau of Standards Handbook H28. Also included are 11 1/2 and 27 threads per inch for pipe, and 4, 6, and 7 1/2 threads per inch for fire-hose couplings. Thirty instrument threads and fine pitches up to 480 threads per inch for watch and instrument work are also available. Metric thread-cutting equipment can be supplied. The double-tumbler gear-box provides for instant selection of seventy power longitudinal-turning feeds and seventy power cross-feeds. An improved lever-operated clutch permits instant engagement or disengagement of power feeds.

The apron handwheel has a swivel machine handle and the cross-feed screw is fitted with ball-thrust bearings to facilitate operation. Both the cross-feed screw and compound-rest screw have satin-finished chromium micrometer collars with widely



Precision bench lathe of improved line announced by South Bend Lathe Works

spaced, easily read, black graduations. Carriage dovetails are fitted with adjustable tapered gibs. Hardened and ground bed ways and cross-feed screw are optional.

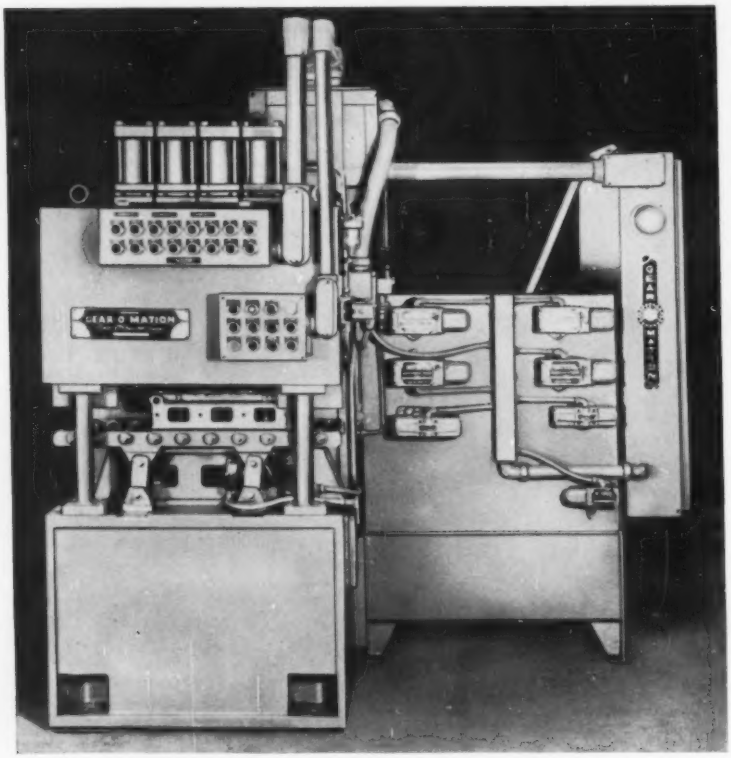
The tailstock spindle is graduated in tenths of an inch to permit accurate drilling to specified depths. The tailstock screw has a micrometer-graduated collar indicating spindle movement in thousandths of an inch. The headstock can be supplied with threaded spindle nose; type L00 long taper spindle nose; or cam-lock spindle nose. Work up to 1 3/8 inches in diameter can be passed through the spindle hole, and the collet will hold pieces up to 1 1/16 inch in diameter. When equipped with a two-speed motor the lathe has 24 spindle speeds ranging from 27 to 1400 rpm. Higher spindle speeds can be supplied to order.

Circle Item 128 on postcard, page 161

Machine for Press Fitting Bushings in Cylinder Heads

An automatic machine for simultaneously pressing all valve-guide bushings into engine cylinder heads has been developed by the Gear-O-Mation Division, Michigan Tool Co., Detroit, Mich. This hydraulically operated, electrically controlled equipment press fits valve-guide bushings at a predetermined force into any one of a group of five different diesel-engine cylinder heads. The heads are for two, three, and four cylinder engines of two types—in-line and V-type—with the three and four cylinder models having either two or four valves on each cylinder. The machine handles the valve-guide bushing insertion for the entire series. It also provides a visible and audible indication (signal light and bell) of any improperly positioned or loose-fitting bushings.

This unit is semi-automatic; the bushings are preliminarily finger-positioned, and the cylinder head manually rolled into and from the



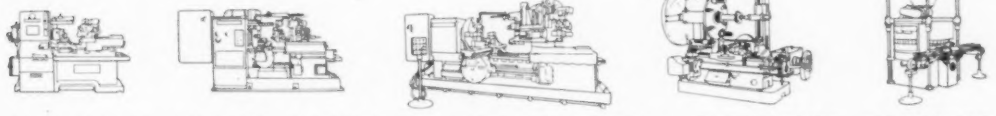
Machine developed by the Gear-O-Mation Division, Michigan Tool Co. for press fitting valve-guide bushings

. . . INCREASE PRODUCTION 45% AND REDUCE MAN-MACHINE HOURS 75%!

American Bosch Arma Corporation, one of the leading producers of automotive, electrical and diesel injection equipment, was using hand turret lathes to machine close-tolerance fuel pump heads. Two of these lathes – each with an operator – were working two 8-hour shifts per day, and a plant-wide survey showed that machining time and costs were too high. Called in to analyze the problem, we recommended two of our P&J 3-U "Speed-Flex" Automatics, with *both* machines to be operated by *one* man on a single 8-hour shift per day.

On the job 18 months, this installation has practically paid for itself in labor savings alone. Now, when the operator receives the workpiece, he chucks it in the first machine, and 12 cuts are completed in a single fully-automatic cycle. He then chucks the part in the second machine, and the remaining 13 cuts are completed. Floor-to-floor time is just 5.5 minutes . . . a 45% reduction over the old method. And 3 machinists have been released for other work.

If your manufacturing operations involve high-speed parts production, a switch from hand machines to P&J Automatics can also bring important benefits to you. Act today. Ask the P&J Representative in your area to analyze your requirements and recommend a production plan that meets your specific needs. If you prefer, write direct to Potter & Johnston Company, Pawtucket, Rhode Island.



AUTOMATIC TURRET LATHES . . GEAR CUTTERS . . . PACKAGING MACHINES

POTTER & JOHNSTON

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.

PRECISION PRODUCTION TOOLING SINCE 1898

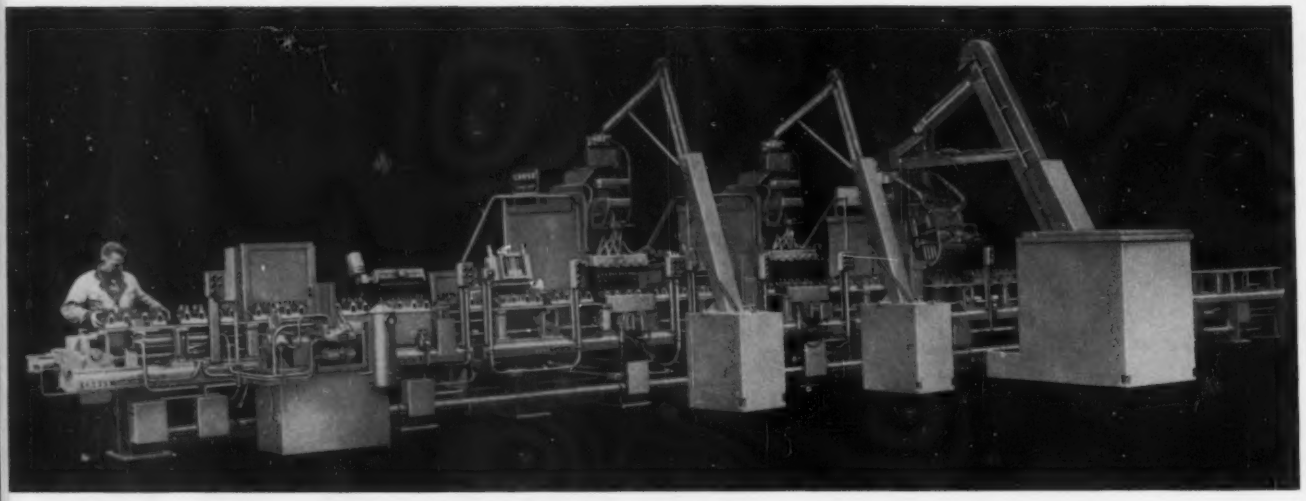


Fig. 1. Assembling machine for V-8 cylinder heads introduced by The Cross Co.

machine. However, the design can be easily modified to adapt it for fully automated production.

In operation, cylinder heads with the bushings held in place by a pilot plate are manually roller-fed to a hydraulically operated end-stop positioner. Each positioner is adjustable to provide for the different cylinder heads. The work cycle is entirely automatic. The table and work are lowered to the pressing position where, if the work is positively positioned, it makes contact with a limit switch controlling the ram action. Each ram is powered from a 3 5/8-inch stroke, 2-inch diameter hydraulic cylinder. Only those rams predesignated by a selector switch descend to press fit the valve-guide bushings of the particular cylinder head being processed. While it is possible to operate all rams simultaneously, the machine is usually set to move them down in sequence. As they return to their dwell positions, they actuate a pressure-switch controlled circuit that raises the work to a roller conveyor that feeds a transfer machine.

Pressures of between 850 and 1300 pounds are imposed on the bushings by the ram, the amount of pressure being adjusted to suit the varying requirements. If a bushing is pressed in with less than a predetermined press fit, visual and audible signals are given to the operator.

Circle Item 129 on postcard, page 161

Transfer Machine for Assembling V-8 Cylinder Heads

The Cross Co., Detroit, Mich., has introduced a twenty-nine station transfer machine designed to assemble V-8 cylinder heads at the rate of 310 an hour. A feature of this automated machine is a transfer mechanism which lifts and carries the parts between the stations, eliminating pallet fixtures such as used in assembling machines of earlier designs.

Cylinder-head castings with intake and exhaust valves in place are loaded automatically at Station 1 of the machine, shown in Fig. 1, while at Stations 3, 4, and 5 rubber grommets are placed over the valve stems. An inspection is made for faulty valves and grommet positioning at Station 7, and, if necessary, heads are removed, repaired, and returned to Stations 8, 9, and 10.

Valve springs, spring retainers,

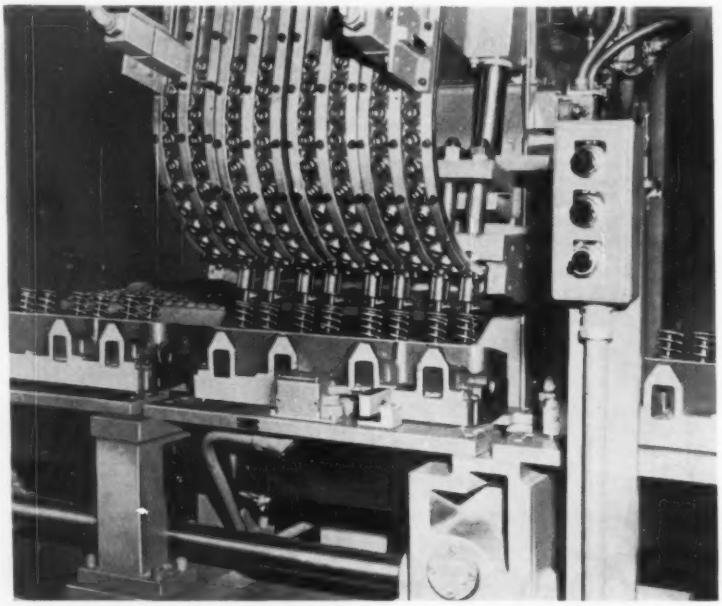
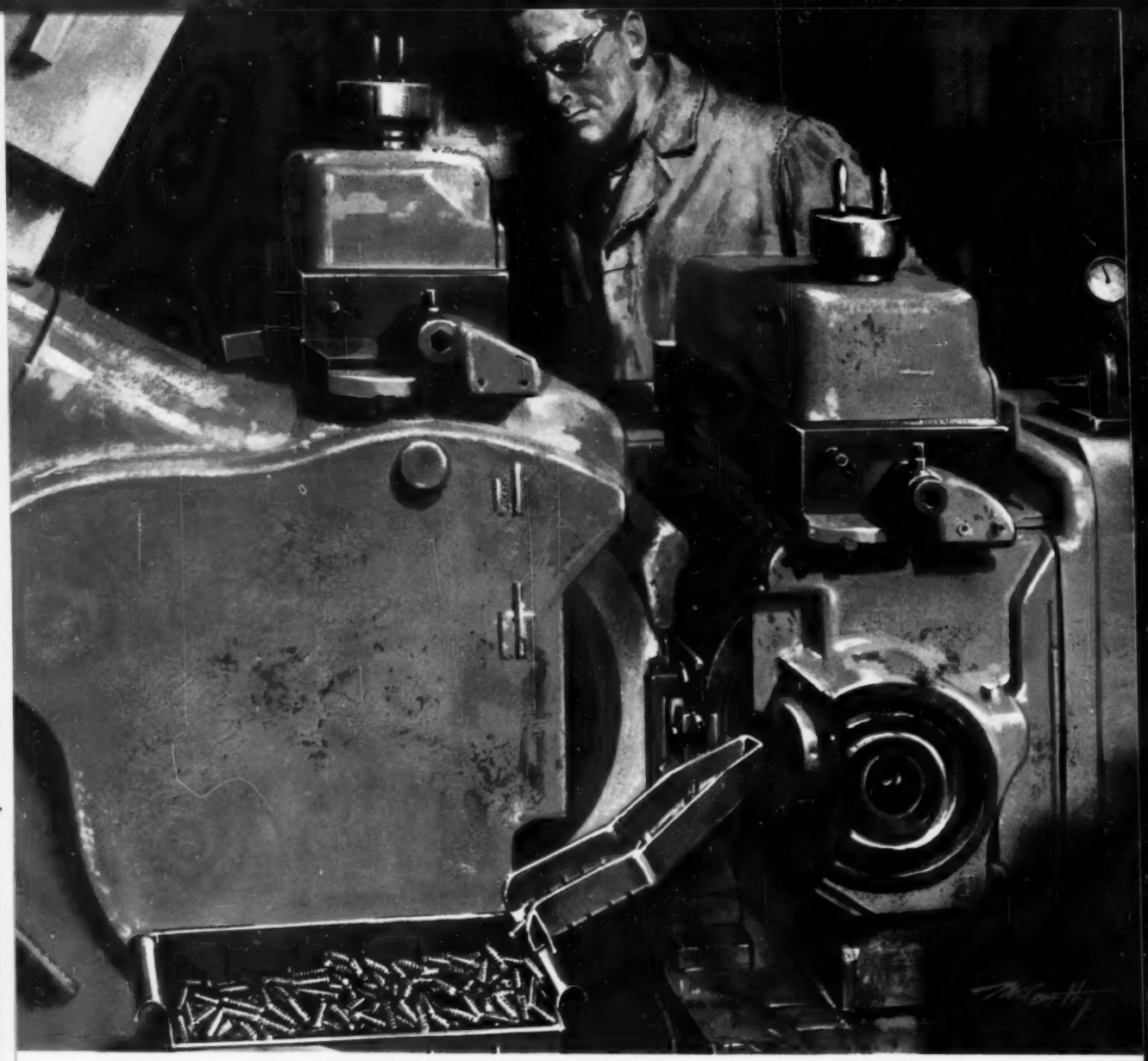


Fig. 2. One of three automatic, valve-spring retainer assembling stations of machine shown in Fig. 1



How 7,000 pieces per hour get the "Touch of Gold"

Here a centerless thread grinder is adding value the most modern way . . . applying the "Touch of Gold" automatically, with a Norton crush-trued wheel that is grinding threads in set screws at an average rate of 7,000 per hour.

You too can benefit by Norton leadership in continually improving grinding wheels and grinding methods . . . which helps proportion your labor, overhead and wheel costs as favorably as possible, so that you can produce with increased efficiency and economy.

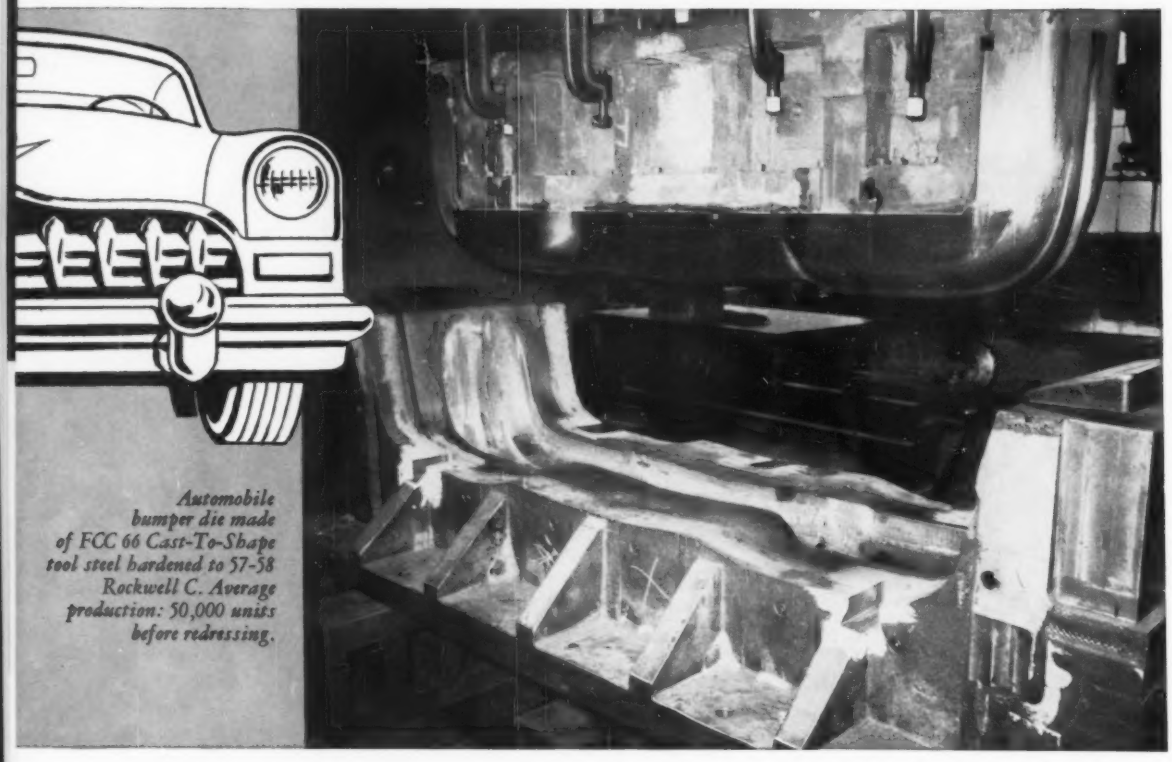
Norton stocks more than 200,000 types and sizes of grinding wheels . . . and brings to every industrial area the many products and services that have become synonymous with the "Touch of Gold".

NORTON COMPANY, General Offices, Worcester 6, Massachusetts.

NORTON
ABRASIVES

Making better products . . . to make your products better

Try this money-saving method that auto-makers use



Automobile bumper die made of FCC 66 Cast-To-Shape tool steel hardened to 57-58 Rockwell C. Average production: 50,000 units before redressing.

A-L CAST-TO-SHAPE TOOL STEELS

Auto makers, too, are included in the long list of manufacturers enjoying the advantages and economies of A-L Cast-To-Shape tool steels. By this modern, money-saving method of tool and die making, it is possible to cast even intricate shapes to within an eighth of an inch of finished size. The savings in time and material over that of machining from solid stock are readily apparent.

A-L Cast-To-Shape tool steels are offered in a variety of grades, and are electrically melted to precise laboratory standards. They are remarkably resistant to abrasion and possess great compressive strength. In many cases, they out-perform tools and dies made from solid bars and forgings.

Remember, with A-L Cast-To-Shape tool steels, you buy less steel originally, and you have less machining to do for finish. Ask your A-L representative about them TODAY . . . or write *Allegheny Ludlum Steel Corporation, Forging and Casting Division, Wanda and Jarvis Avenues, Detroit 20, Michigan.*

SEND FOR THIS NEW CATALOG
"FORGING AND CASTING PRODUCTS"

Contains the latest information on FCC Air Hardening, Oil Hardening and other Cast-To-Shape Tool Steel Specialties that can save you time and money . . . also Composite Die Sections and Smooth Hammered Forgings in a wide range of tool and stainless steels. *Don't wait—get your copy NOW.*

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and spring-retainer sleeves are automatically assembled at Stations 11, 13, and 15, respectively. One of the three assembling stations of the machine is shown in Fig. 2. Valve locks are automatically assembled at Stations 17 through 23, stand-by units for manual assembly also being provided at Stations 19 and 23. All valves are "popped," or tested, for functioning at Station 25 before the finished assemblies are unloaded at Stations 27, 28, and 29.

Building-block construction of the machine provides flexibility for engine design changes and for additional automatic assembly devices when needed. All parts, including tooling, are made to tolerances that permit interchangeability, thus facilitating maintenance.

Circle Item 130 on postcard, page 161

Monarch "Missile Master" Contouring Lathe

A lathe designed for precision contour-turning, boring, and facing of missile nose cones, nozzles, motor cases, airframe sections, hemispherical and elliptical domes, and other large thin-walled and fabricated parts, has been developed by the Monarch Machine Tool Co., Sidney, Ohio. This lathe, called the "Missile Master," has been specifically designed to meet missile-industry requirements for large swing capacity, ultra-close machining tolerances, and critical surface finishes. The swing over the ways is 85 inches, and over the cross-slide, 67 inches. Bed lengths are available up to 300 inches between centers in increments of 48 inches. The lathe is equipped with the Monarch swiveling air-gage tracer-contouring system.

The speed range through faceplate drive is sufficiently broad to handle a wide diameter range. For example, a surface speed of 150 feet per minute can be maintained constantly over a diameter range of from 19 to 71 inches, using only the highest speed setting in the eight-speed, faceplate drive.

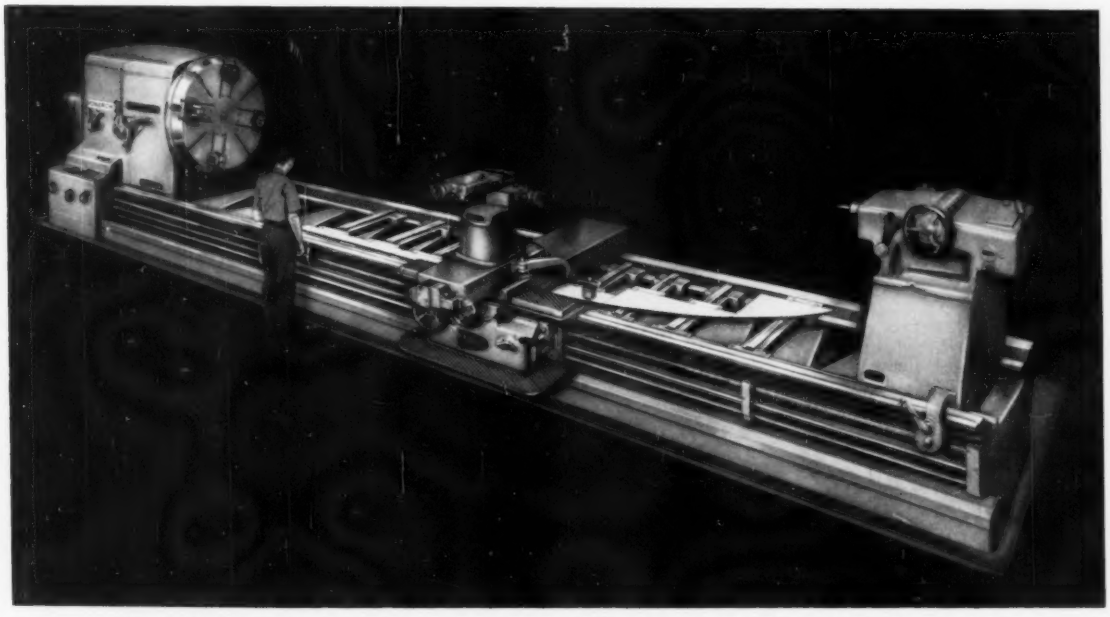
The eight speeds available when using the faceplate drive range from 1 1/4 to 30 rpm. The sixteen speeds in the high-speed group range from 1 1/4 to 250 rpm with the driving power applied directly through the spindle. Since the main drive motor is a 4-to-1 variable-speed, direct-current type, each of the lathe's twenty-four speed settings is infinitely variable within a 4-to-1 ratio range.

A range of forty-eight commonly used threads and feeds is provided. The range of threads per inch is 2 to 112 and the range of feeds per revolution is 0.00075 to 0.0421 inch.

Power for actuating the tracer slide is supplied by the lathe's regular hydraulic system. This equipment can be used as a manually operated machine at any time, switch-over from tracer to manual control being accomplished by the flip of a lever. Tracer-stylus pressure against the template is only about five ounces.

The template for contour work is mounted atop the extra-wide bed, permitting tracing with a template diameter variation of as much as 35 inches. For facing operations, an across-the-bed template support is furnished. Two tool-adjusting slides are mounted at right angles to each other on the air-gage tracer slide to provide for longitudinal adjustment between the tool and the template when setting up for a new work-piece.

A range of eight, extra-low spindle speeds is optionally available for use in thread-milling operations such as required on some missile hardware. Through a separate gear train atop the headstock, a driving pinion is engaged with the faceplate internal ring gear, giving low-range speeds



"Missile Master" contour-turning, boring, and facing lathe developed by Monarch Machine Tool Co.

from 1/32 to 3/4 rpm. Employing a circular feed of 6 inches per minute, the lathe is capable of milling threads on any missile component between 2 1/2 and 67 inches in diameter.

Circle Item 131 on postcard, page 161

Automatic Assembling and Precision Boring Machine

The F. Jos. Lamb Co., Detroit, Mich., has designed and built an automatic assembling and precision boring machine that processes 400 stator-support assemblies per hour. Two parts are processed simultaneously. In an eighteen-second machine cycle, hopper-fed bushings are pressed into parts which are then transferred to the precision boring station for machining to plus or minus 0.0005-inch accuracy limits on the diameter and 0.002-inch total indicator reading for squareness and concentricity. Fig. 1 is a front view of the precision boring machine, and Fig. 2 is a view looking down on the assembling and boring units connected by the work-transfer mechanism.

The machine was designed for possible future integration into an automated transfer line. The press station can be separated from the boring station to permit the addition of other processing equipment between these two units. Separate electrical panels, controls, lubrication systems, and hydraulic power equipment make each unit a self-contained machine. A walking-beam transfer mechanism joins the two machines into a single, compact unit.

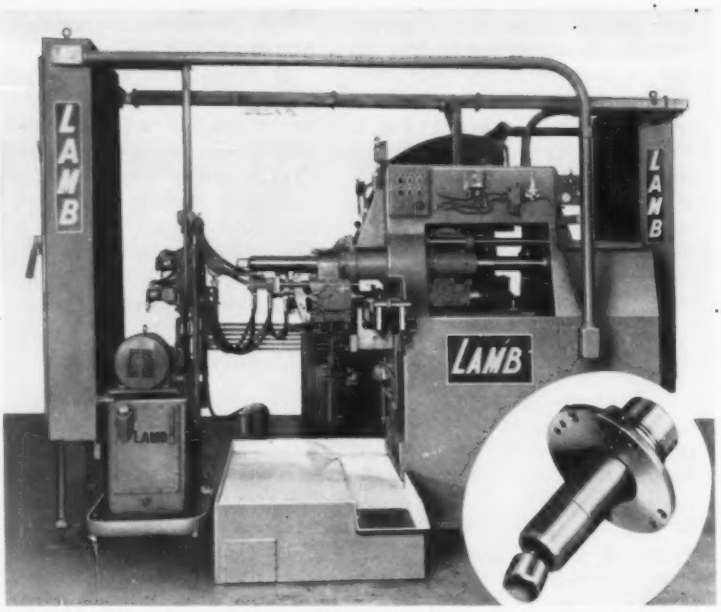


Fig. 1. Front view of precision boring unit of stator-support processing machine announced by the F. Jos. Lamb Co.

The hopper at the press station has a capacity of approximately 3000 bushings. The bushings have an outside diameter of 1.180 inches and a length of .1 inch. Bushings that require an assembling pressure of less than 2800 pounds are registered as rejects on the signal-light panel. A signal light indicates when there is no bushing in the feed chute and when a faulty bushing is present.

At the boring station, parts are located on centers that can be micropositioned to maintain concentricity. Floating clamps prevent the parts from rotating due to machining torque. Two friction-drive precision boring heads with micro-adjustment facilitate control of the hole size. Rapid approach, feed, and return cycles are cam-controlled. The boring heads travel on round, hardened ways, and pre-loaded linear ball bearings. Overhead ways, fixturing, and transfer bar are completely clear of the metal-cutting area which allows all chips to fall into the chip chute in the machine base. The boring heads can be withdrawn 11 inches to facilitate changing the pre-set tools.

The machine may be operated manually or automatically as part of a transfer line.

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(*This section continued on page 176*)

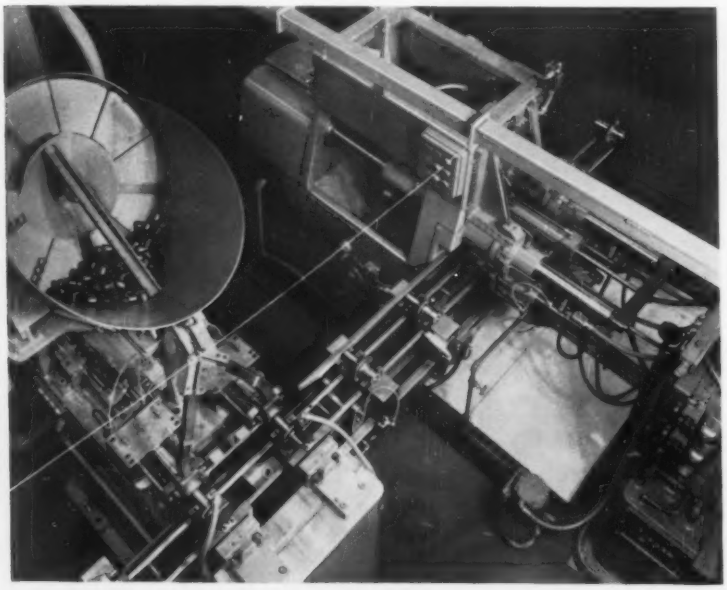


Fig. 2. View looking down on assembling and precision boring units of machine illustrated in Fig. 1

Extractor for Separating Oil and Metal Chips

A simple and convenient low-cost oil extractor for separating oil from metal chips is being manufactured by the Poly-Metal M & T Co., New York City. This extractor works on the principle of gravity plus surface-tension breakage.

A shop-size, 24-inch diameter drum, with a few holes in the bottom and in the side near the bottom end, is placed on the concave disc of the oil-extractor unit shown in the accompanying illustration. The oil from the cuttings put into the drum flows through the center holes in the disc to the sliding pan below.

The radial ribs on the concave disc taper to the edge and raise the drum to permit a better flow of oil. By touching the bottom of the drum, the ribs form a continuous runway, breaking the surface tension of the oil and adding considerably to the oil-separating effect of gravity. The rim on the outside edge of the disc prevents the drum from sliding off while the oil extractor is being moved, yet it is not too high, allowing for simple easy removal of drum.

Poly-Metal oil extractor designed to take drum 24 inches in diameter

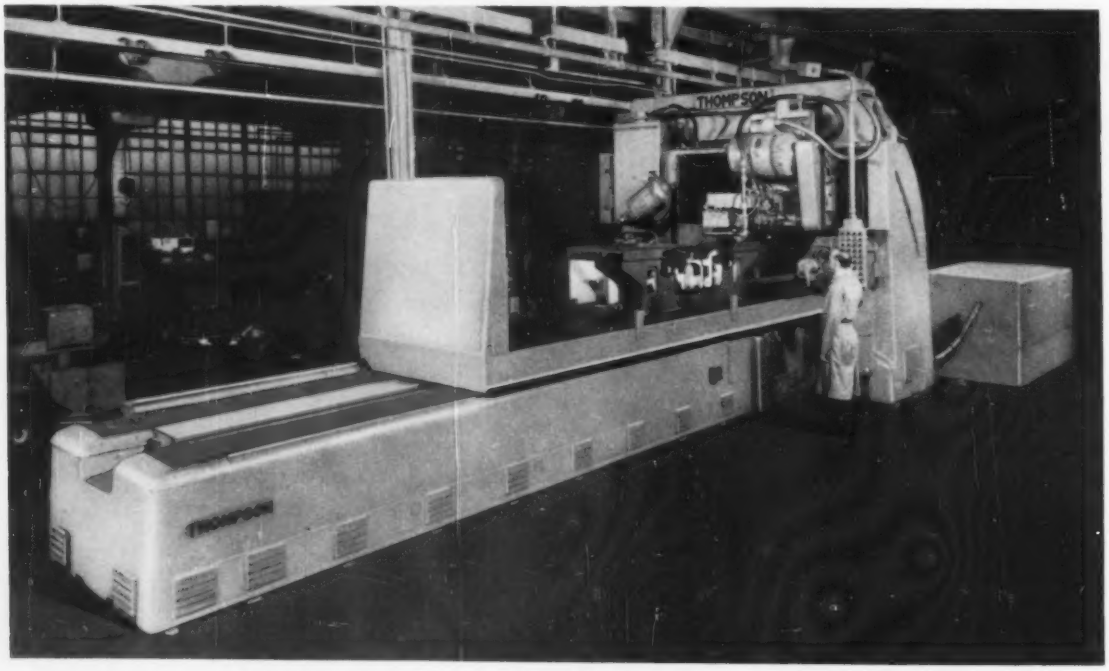
The casters on a heavy frame are of the ball-bearing type. They swivel within the area of the extractor, adding to its space-saving features. The sliding pan, folded from one piece of metal, is wired around the top for reinforcement. It has two swivel handles and is leakproof. The frame is cold-formed and welded to straight channels in sixteen places.

Circle Item 133 on postcard, page 161

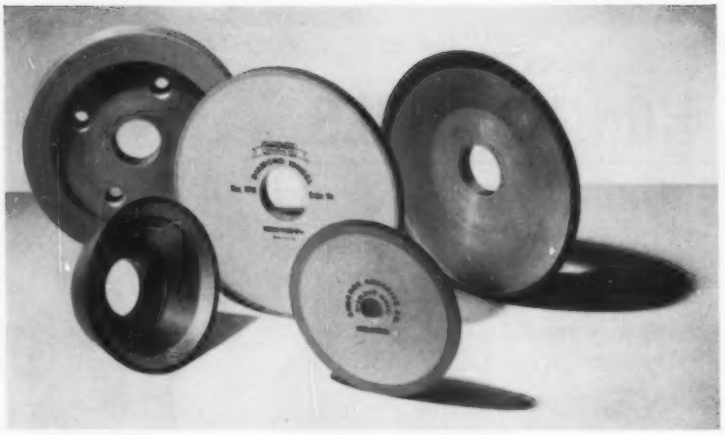
Thompson Hydrail Surface Grinder

Completion of a Hydrail surface grinder, embodying several features relatively new to way-grinder design, is announced by the Thompson Grinder Co., Springfield, Ohio. This machine has a work area of 48 by 36 by 240 inches. It was designed and built for the Landis Tool Co., Waynesboro, Pa., for use in grinding the ways of large machine tools.

In order to have the unit meet the requirements for a positive, fast, and accurate vertical travel it is equipped with anti-friction, recirculating ball nuts. This type of nut reduces the friction be-



Hydrail surface grinder designed and built by the Thompson Grinder Co.



Grinding wheels of man-made diamonds introduced by Simonds Abrasive Co.

tween nut and screw to a minimum and positions the rail more accurately without counterbalancing. It also extends the life of the screw indefinitely. Another special feature is incorporated in the design of the way bearings for the transverse travel of the horizontal and vertical wheel-heads. Here, a recirculating roller chain contacting hardened and ground vee ways provides a high degree of accuracy and positive transverse movement.

The machine is provided with the Thompson "Hydra-Cool" hydraulic system which, by reducing hydraulic heat to the minimum, eliminates heat distortion throughout the machine. In a surface grinder with a work length of 20 feet, heat distortion would become a critical problem in holding the close total tolerances for which the unit was designed. However, because of the Hydra-Cool system, an accuracy within 0.0007 inch can be held over the entire work area.

Independent operation of the horizontal and vertical wheel-heads is another design feature. The horizontal wheel-head regularly provides 40 hp, with higher horsepower available, and uses a 24- by 6- by 12-inch grinding wheel at 1200 rpm. The vertical head has an inclinable spindle and provides 10 hp and up, with a 12- by 3- by 5-inch grinding wheel at either 1800 or 3600 rpm. The machine can be operated from either side by dual manual controls and a pendant, electrical control station. Wheel truing is done by a head-mounted, 90-degree included-angle device for the horizontal head.

The equipment has dual, packless cylinders. The table is supported on large vee and flat ways that are pressure lubricated by a separate oil system. All bedways and vertical ways are protected at all times against the abrasive action of grit and grinding dust. The complete machine weighs 80 tons, is 13 feet wide, 13 feet high, and has an over-all length of 52 feet 9 inches.

Circle Item 134 on postcard, page 161

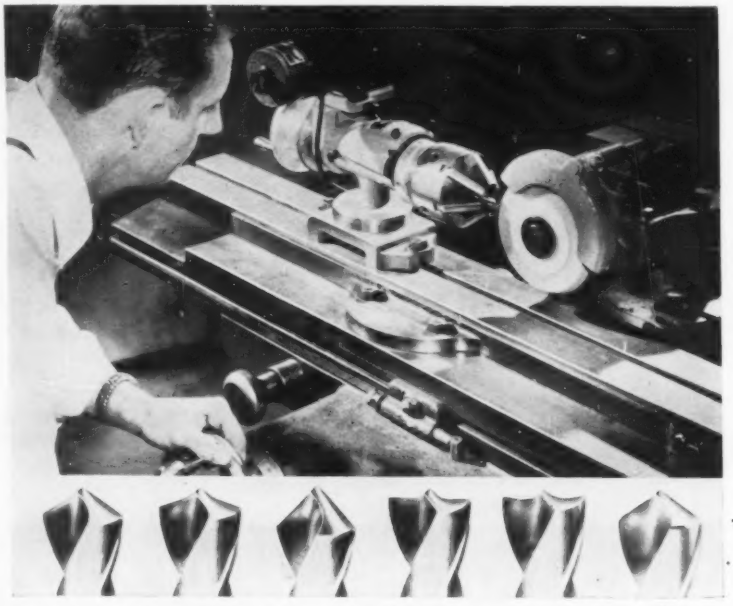
Grinding Wheels of Man-Made Diamonds

A line of diamond grinding wheels featuring man-made diamonds is being introduced by the Simonds Abrasive Co., Philadelphia, Pa., grinding-wheel division of Simonds Saw & Steel Co., consisting of resinoid- and vitrified-bonded wheels using man-made diamonds. The line includes wheels of all standard sizes and shapes, diamond depths, concentrations, and grain and grade specifications. Metal-bonded type wheels are furnished with natural diamonds. Resinoid- and vitrified-bonded wheels may also be supplied with natural diamonds, if desired. Man-made diamonds in resinoid-bonded wheels are said to be especially adapted for grinding the very hard, cemented carbides.

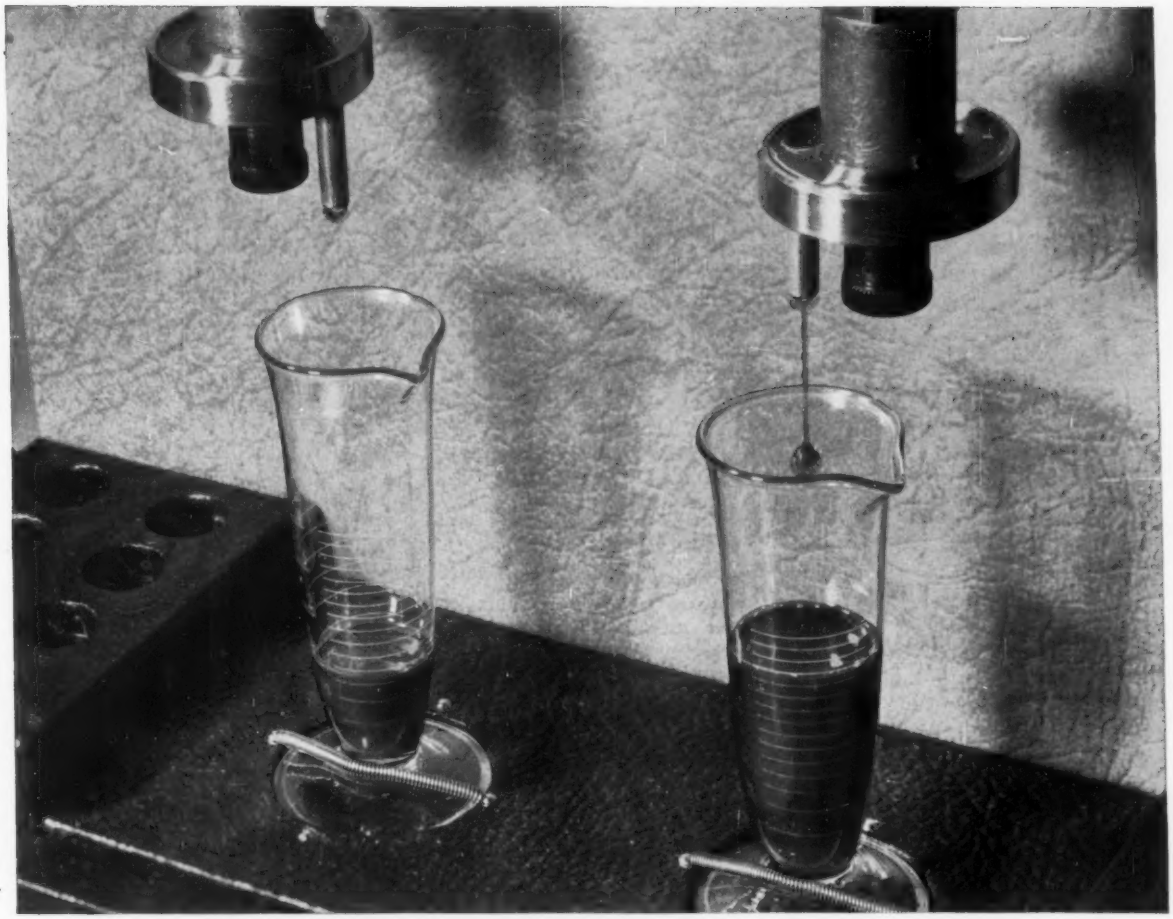
Circle Item 135 on postcard, page 161

"Helixpoint" Self-Centering Drill Point and Relief-Grinding Fixture

The Steptool Corporation, Los Angeles, Calif., has developed a drill point designated the "Helixpoint," and a low-cost fixture for grinding the new point. The fixture can be used on any surface, tool, or cutter grinder.



Steptool fixture for grinding Helixpoint points on drills such as shown in the lower views



The oils collecting in these graduates are being forced, at 100 psi, through two sintered bronze bearings. Although each oil has the same viscosity, the Suntac on the left is leaking *only one quarter as much as* the straight oil on the right.

Desk-top demonstration proves that SUNTAC HYDRAULIC OILS can cut your oil losses . . . up to 75%

Suntac® oils are competitive in price, competitive in quality, *and unique in their ability to reduce oil leakage without costly shutdowns.*

Suntac oils are high-quality, exceptionally stable mineral oils especially compounded to reduce leakage. Experience proves that they give longer pump and seal life with higher over-all operating efficiency.

See for yourself how a Suntac oil can cut your oil costs. A simple desk-top demonstration will show you how.

Ask your Sun man to show you how others have reduced oil consumption, or write to Dept. M-8.

Industrial Products Department

SUN OIL COMPANY, Phila. 3, Pa.

SUNOCO

In Canada: Sun Oil Company Limited, Toronto and Montreal

For more information fill in page number on Inquiry Card, on page 161

The outstanding advantage of the Helixpoint is its self-centering action. A drill with this point is said to have no tendency to "walk" and remains steady in the hole as drilling progresses, offering no side displacement. Thus, round, accurate holes free from "bell-mouth" are produced. In many cases it is not necessary to center drill or center punch the work and no drill bushings are needed.

The Steptool relief-grinding fixture and grinding technique permit the forming of an unlimited variety of Helixpoint configurations and clearance angles. By their usage they can be divided roughly into three general classifications: normal Helixpoint for general purpose drilling; extreme Helixpoint for aluminum and non-ferrous materials; and moderate Helixpoint for tough steel and iron. Among the shapes that can be used for specific drilling applications (shown in the lower views of the accompanying illustration) are: general purpose; tough steel or iron point; non-ferrous and plastic point; sheet metal point; trepan or spur point; and protected corner point.

Circle Item 136 on postcard, page 161

Nichols Semi-Automatic Milling Machine with Automatic Indexing Table

The Robert E. Morris Co., Farmington, Conn., national distributors of Nichols milling machines, has introduced a new method for continuous milling of squares on a variety of small parts. The Nichols semi-automatic miller used for this method is equipped with a four-station, automatic, pneumatic-indexing table 10 inches in diameter. The table presents each part to two pairs of straddle milling cutters, leaving two stations free for loading and unloading.

Automatic pneumatic down feed to the spindle head is synchronized with the table feed and automatic indexing of the rotary table. Two sides of the square are milled with each indexing cycle, the square being completed after one 90-degree indexing of the rotary table. Thus the operation is continuous, with the operator required only to unload and load the work. Feeds are variable up to 60 inches per minute, and timing is adjustable to suit the operator. The machine has a 1 1/2-hp. geared-head motor. The table is 8 1/2 by 30 inches. Spindle speeds up to 5000 rpm are available.

Circle Item 137 on postcard, page 161

"Ace" Grinding Machine for Sharpening Circular Saws

The Oliver Instrument Co., Adrian, Mich., has brought out a grinding machine for sharpening metal- and wood-cutting circular saws. This machine, called the "Ace," can also be used for sharpening face mills, reamers, hobs, spot-facers, straight and spiral cutters, as well as various wood-cutting tools.

Circle Item 138 on postcard, page 161

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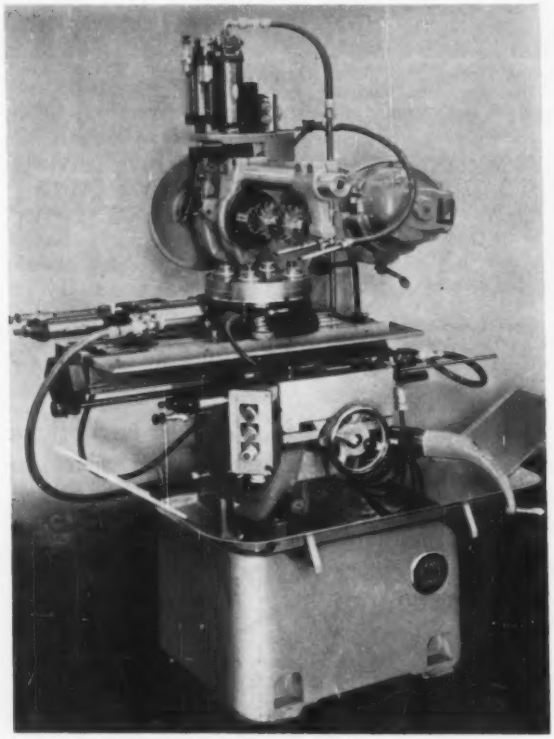
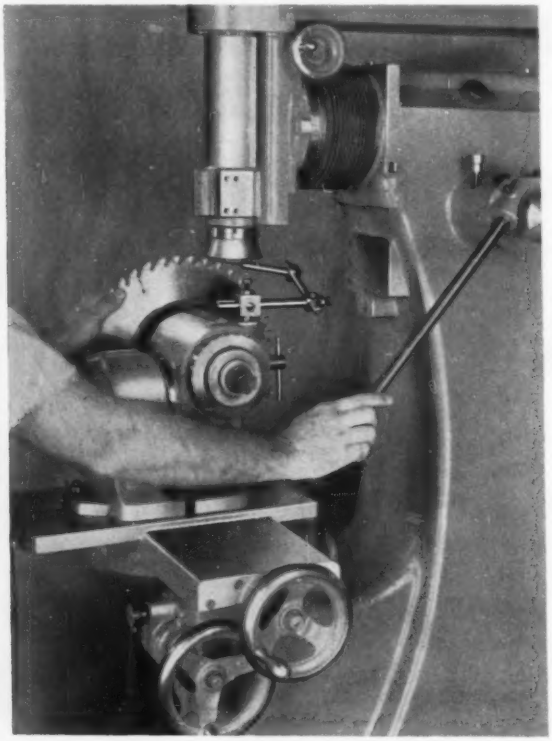
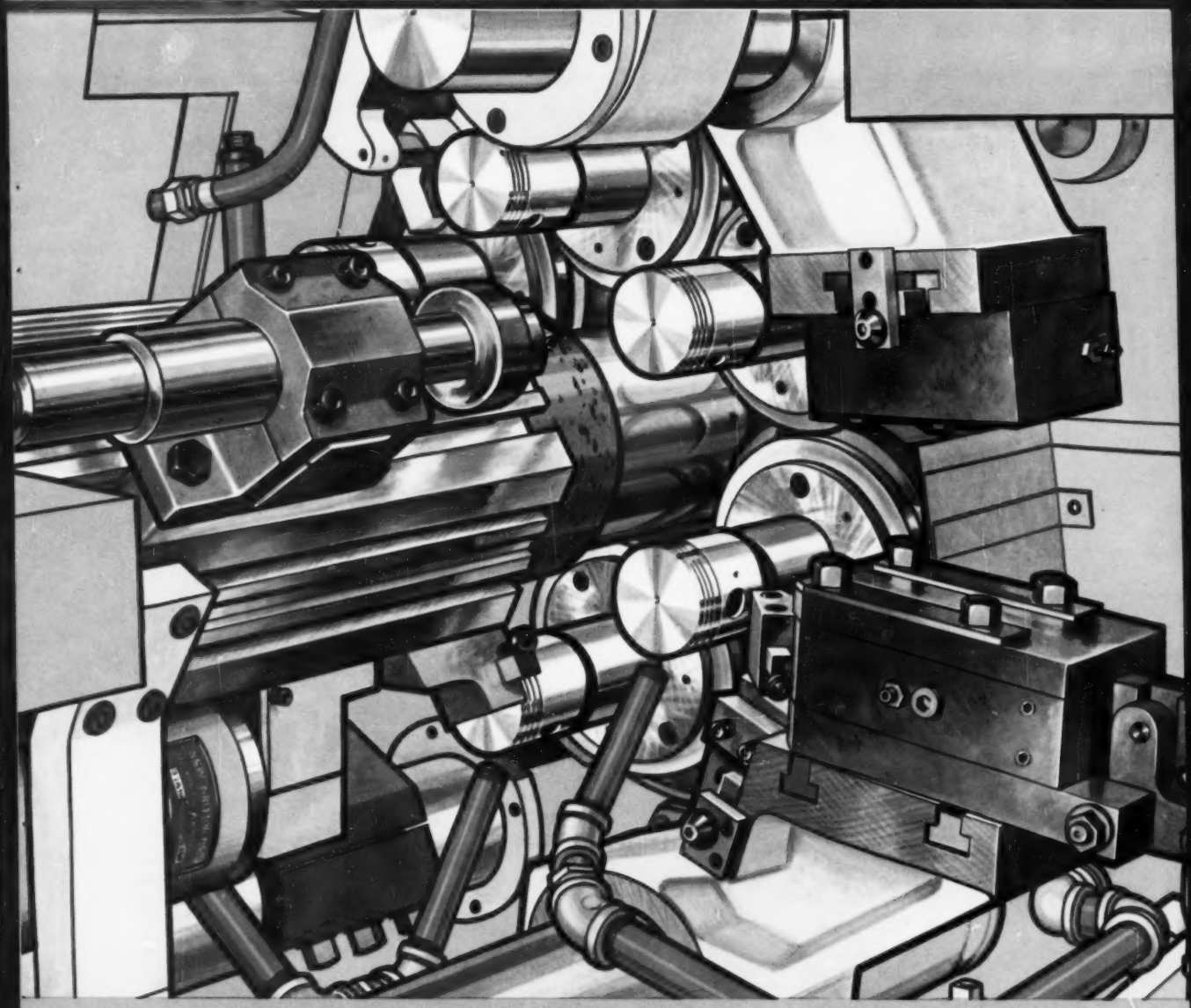


Nichols milling machine introduced by the Robert E. Morris Co.



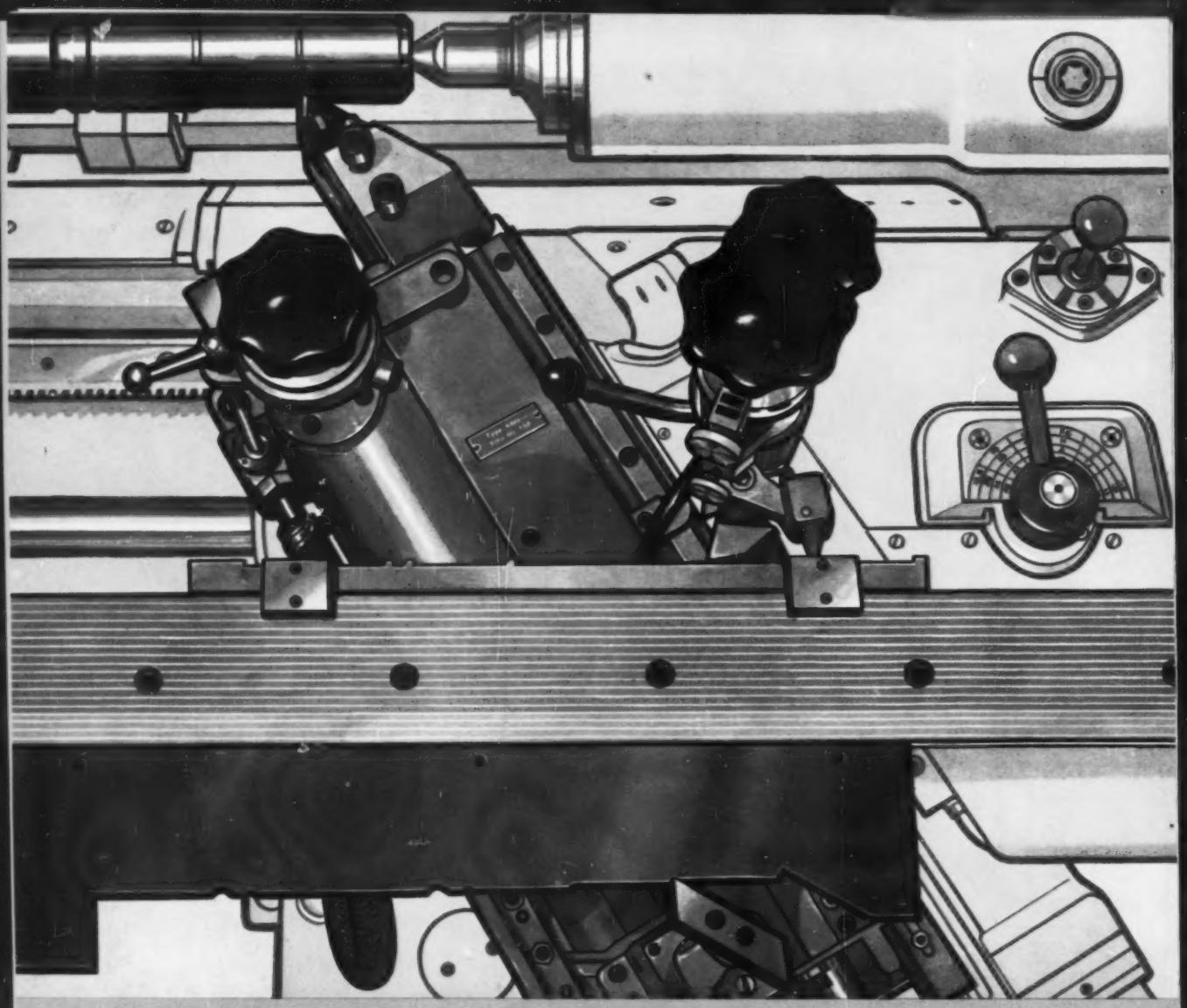
Oliver "Ace" grinding machine designed for sharpening circular saws



make higher production pay for itself

A New Britain four-, six- or eight-spindle chucker with open-end design, massive forming arms, large capacity (up to 15″) will machine your castings and forgings faster at less cost. You can measure it in *income* instead of *cost* because New Britain Chuckers pay as they go. New Britain's new financing plan makes large initial investment unnecessary. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

NEW BRITAIN CHUCKING MACHINE



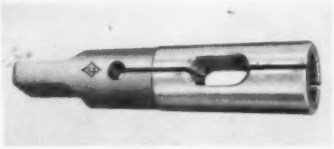
you don't make money adjusting tools

With a New Britain +GF+ Copying Lathe you outproduce gang tool setups because you cut at maximum speeds and feeds for tool efficiency. No tool-wear worries! The single tool is changed in one minute. Every dimension is positively transmitted from template to work, making adjustment a simple matter of bringing one dimension to size — the others *have* to be right. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

NEW BRITAIN +GF+ COPYING LATHE

Improved Drill Sleeves

Split drill sleeve of line brought out by the Cleveland Twist Drill Co., Cleveland, Ohio, designed to reduce drilling costs when used with straight-shank tanged drills. A high degree of concentricity is maintained between the hole and the body. The sleeves are offered in four taper sizes—A.S.A. Taper Shanks No. 1, No. 2, No. 3, and No. 4, for handling the most



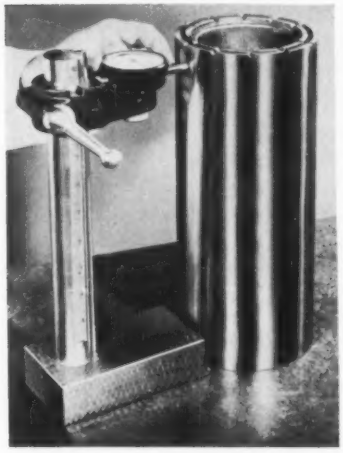
widely used drill sizes, including fraction sizes from 1/16 to 1 inch, wire-gage sizes No. 1 to No. 52, and letter sizes A to Z.

Circle Item 139 on postcard, page 161

Gage for Inspecting Squareness

"Trans-Square" for inspecting the accuracy of perpendicular surfaces announced recently by the DoALL Co., Des Plaines, Ill. The lapped reference lip on the Trans-Square base is placed against a master square and moved across until the highest reading is obtained. The dial indicator is then "zeroed" in. The master square is removed and the work-piece to be checked is placed into contact position with the Trans-Square. The variation from perpendicularity can then be read directly.

Circle Item 140 on postcard, page 161



Solid-Carbide Boring Tool

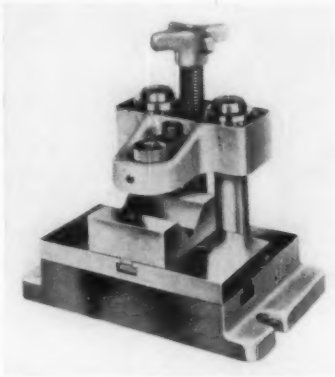
Solid-carbide Series 2015 boring tool with standard 3/8-inch diameter shank for use in precision jig-boring announced by the Atrax Co., Newington, Conn. It has a hardened and ground steel shank

3/8 inch in diameter by 1 inch in length. Eight tools in the series bore holes with minimum diameters ranging from 0.090 to 0.300 inch. Stocked in grade C-2 carbide. Other grades available upon request.

Circle Item 141 on postcard, page 161

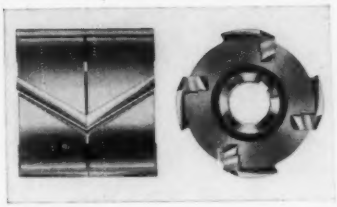
Adjustable V-Block Drill Jig

"Repco" adjustable V-block drill jig designed to cut costs of precision-center or off-center drilling, tapping, and reaming announced by Rockford Engineered Products Inc., Rockford, Ill. Standard equipment of the new drill jig includes two interchangeable V-blocks, three interchangeable adapter bushings, and a centering



locator plug. Four-way adjustment and simplicity of setup save time on both small-lot and production work. The jig handles work-pieces up to 2 inches in diameter and accommodates standard ASA drill-jig bushings for drills from 0.0135 to 0.5625 inch in diameter.

Circle Item 142 on postcard, page 161



"Double Life" Inserted-Blade Milling Cutter

Inserted-blade plain milling cutter for machining aluminum which has a patented blade design said to provide twice the normal grinding life of regular inserted blades announced by Goddard & Goddard Co., Detroit, Mich. Cutters using the "Double Life Blades" come in 4-inch wide right- and left-hand sections. These are recommended for use in gangs as illustrated.

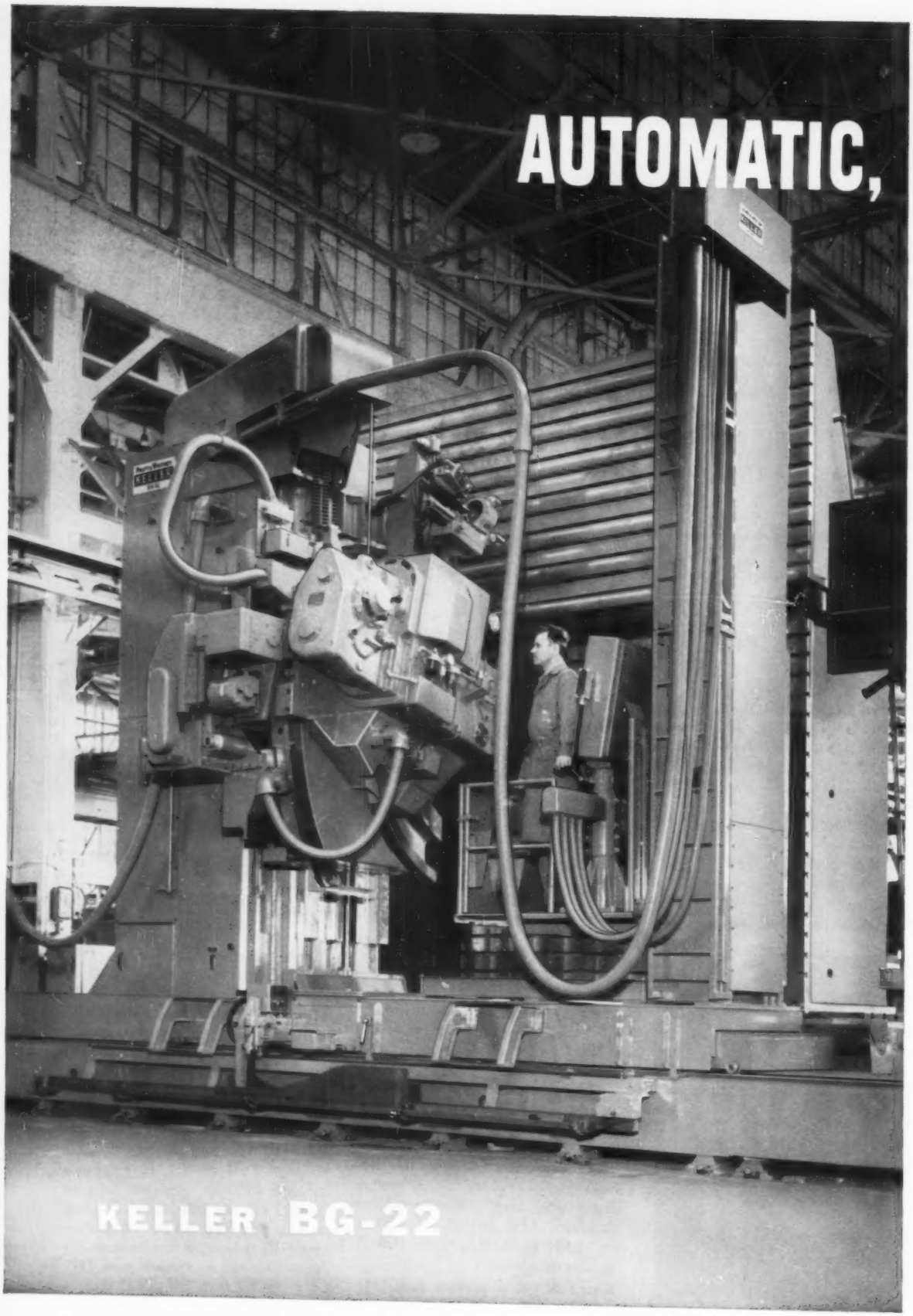
Circle Item 143 on postcard, page 161

Tapmatic Tapping Attachment

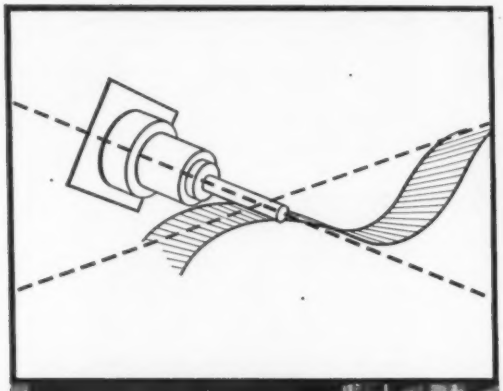
Featherweight Tapmatic "100" tapping attachment announced by the Tapmatic Corporation, Costa Mesa, Calif. This attachment is designed to meet the need in industry for a compact, lightweight tapping unit. It weighs only 10 ounces, has a maximum diameter of 1 5/8 inches, and a maximum length of 3 1/2 inches. The rated capacity for tapping in steel is from No. 00 to No. 6. Features include lifetime, positive torque-control clutch; free, axial floating action; and instantaneous, planetary-ball reversing mechanism.

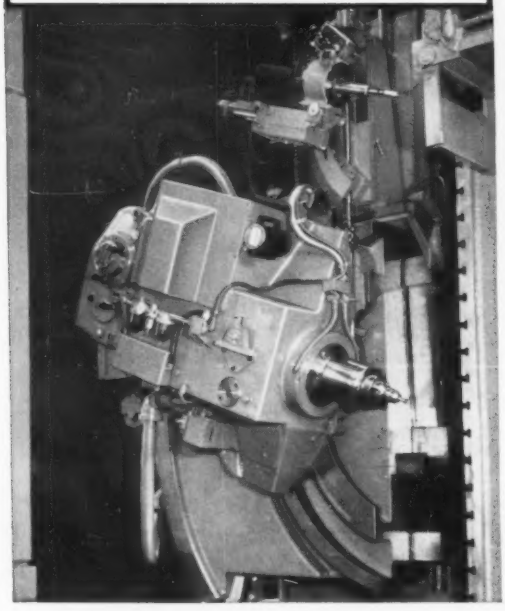
Circle Item 144 on postcard, page 161

(*This section continued on page 184*)


AUTOMATIC,
KELLER BG-22

here's a NEW TWIST *in*
TRACER-CONTROLLED MILLING





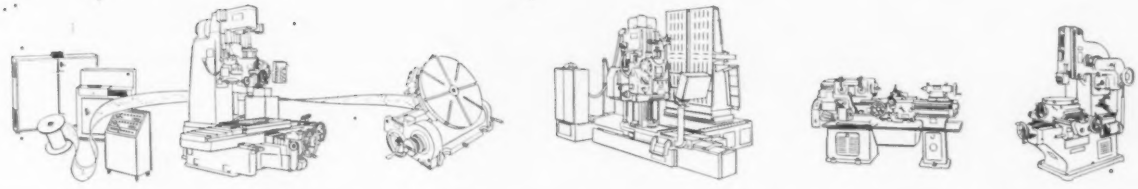
Pratt & Whitney Keller Automatic Tracer-Controlled Milling Machines have long been known throughout industry for their ability to produce complex, irregular 2- and 3-dimensional shapes. They bring outstanding speed, accuracy and economy to the manufacture of dies, molds, prototypes and production parts.

The special machine shown here – a modification of our giant Type BG-22 – adds a "new twist" to the already great versatility of these machines. This special machine can be operated as a standard Keller . . . profile-milling from a 2-dimensional template or duplicating a 3-dimensional full model. In addition, it is equipped with a specially designed milling head that has a range of tilt from 20° above to 20° below the horizontal. With the degree of tilt of the head and cutting tool controlled by a template, this machine will be used to generate "warped surfaces" by profile milling. This type of milling is frequently encountered in the production of aircraft structural components where the outer surfaces of the part must be accurately profiled and, at the same time, correctly twisted or "warped" to conform with the designed contours of the aircraft's surfaces. The development of this special Keller Machine makes it possible to produce these "warped surfaces" by the most direct, accurate and economical method.

Your own operations may not involve the milling of "warped surfaces." But the example of this special machine demonstrates Pratt & Whitney's experience and engineering know-how in solving special production problems. And – whatever your requirements – for fast, low-cost milling of irregular shapes and complicated curves, there's a P&W Keller Machine just right for every work size with capacities ranging from 36" x 20" to 20 feet by 7 feet.

Write now for complete information . . .

PRATT & WHITNEY COMPANY, INC.,
12 Charter Oak Blvd., West Hartford, Connecticut

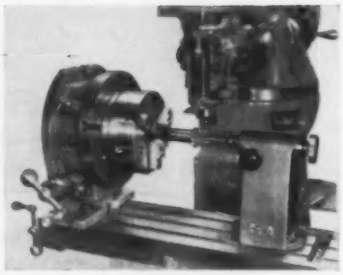


NUMERICAL CONTROL . . . JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS



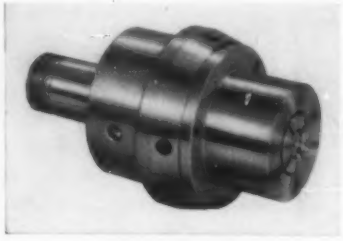
Universal Rotary Table

Universal rotary table equipped with chuck and tailstock for machining a serrated shaft, brought out by the Universal Vise & Tool Co., Parma, Mich. In addition to the regular 12-inch rotary table originally introduced, the manufacturer is now producing 9- and 15-inch sizes. Both models can be used horizontally as well as vertically. Tailstock accessory allows tables to be used in vertical position for holding work between centers.

Circle Item 145 on postcard, page 161

Hardinge Expanding Collet

Expanding collet for precision internal chucking developed by Hardinge Brothers, Inc., Elmira, N. Y., to simplify tooling, handling, and machining operations. This collet is designed for use on Hardinge toolroom and production lathes. It is precision-built, shop-tested and approved for universal application. The exact concentricity of the expanding-collet unit makes it easy to obtain concentric and square shoulders, faces, and turned surfaces on a work-piece located from a previously machined bore. Exact work lengths are easily obtained. Both the stationary expanding collet and work-locating stop have no end movement.

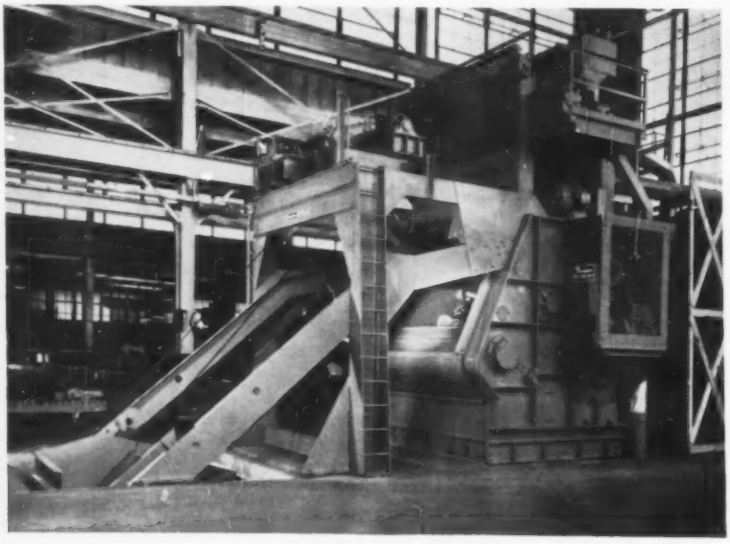


Circle Item 146 on postcard, page 161

Huge "Rotoblast" Barrel

"Rotoblast" barrel with a capacity of 72 cubic feet introduced by the Pangborn Corporation, Hagerstown, Md. This equipment will blast-clean a load of castings, forgings, or heat-treated parts weighing up to 6 tons in five minutes. It is designed for foundries, forge shops, heat-treating plants, and other metalworking factories which clean and descale large volumes of heavy parts. The barrel is equipped with two Rotoblast wheels, each capable of throwing 120,000 pounds of abrasive per hour. Each wheel is powered by a 40-hp motor. Heavy-duty motors are also utilized to power the shaker conveyor, the barrel door, and the abrasive elevator. All operations of the barrel, including loading, starting, stopping, and unloading, are performed automatically. The tumbling barrel is 21 feet 5 inches wide by 10 feet 11 inches deep by 23 feet high.

Circle Item 147 on postcard, page 161



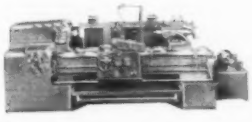
Coated Abrasive Polishing and Finishing Wheels

Coated abrasive wheels of a new flap design for polishing and finishing contoured as well as flat metal surfaces, developed by Behr-Manning Co., Troy, N.Y., a division of the Norton Co. This wearable wheel is made up of hundreds of pieces of coated abrasive cloth, with a stiffened construction which allows it to resist pressure, give excellent production rates, and a long useful life. The new wheel is particularly suited for use on fully automatic polishing operations. Also, it may be used on any standard bench grinder in place of a wire brush for many small polishing jobs. The flap wheel is furnished with aluminum-oxide or silicon-carbide abrasive in a wide range of grit sizes, a variety of hole sizes, and in wheel sizes from 6 by 1 up to 16 by 6 inches. Ten-inch and smaller wheels are furnished with built-in, disposable, metal flanges. Re-usable flanges are sold separately for use with the larger wheels.

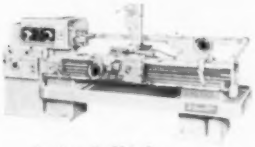
Circle Item 148 on postcard, page 161

V-R Toolholders and Carbide Inserts for Tracer Lathe Operations

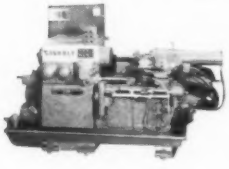
Monarch



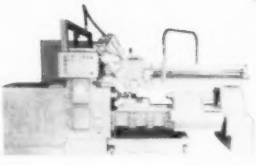
American



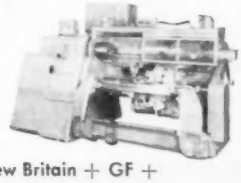
Lodge & Shipley



Gisholt



Seneca Falls



New Britain + GF +

There is a complete line of V-R toolholders for all profiling operations . . . *plus* styles, sizes and grades of cemented carbide inserts for every requirement. Standard V-R carbide grades give superior results on the majority of operations. Special grades are available for unusual applications.

Let your qualified V-R field service engineer help you select and apply the toolholders and inserts that will give you optimum results on any job.

ASK FOR NEW TOOLHOLDER MANUAL
—52 pages of technical data on the selection and use of V-R toolholders—Yours for the asking, without obligation.

TH-643

MANUFACTURERS OF:
CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

880 Market Street • Waukegan, Illinois

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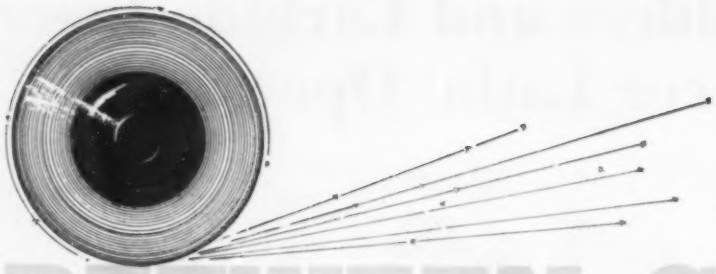


By E. S. Salichs

BETWEEN GRINDS

Jump, Jeep

A 700-pound, four-seater British jeep, called the Harrier, has been designed by Hunting Percival Aircraft, Ltd., England. It folds into a neat box 9 feet long which can be parachuted from aircraft. The folded vehicle can be made ready for use by its crew of four in one minute; they then hop inside two hinged sheet-metal panniers, one on each side of the chassis, and away the Harrier goes uphill, down dale, and through a foot of water.

Boys' Bonanza

American Machine & Foundry Co. in Greenwich, Conn., recently helped a local boys' club salvage 22,000 pennies from sealed envelopes which had been generously turned over to the club by *Reader's Digest*. The magazine had held a circulation drive in which shiny pennies attached to literature had been sent through the mails. Numerous envelopes were returned due to incorrect address, and so on. A director of the club, also a V.P. at AMF, took over and had his development men design a machine to extract the loot. While this equipment was running, one of MACHINERY'S representatives happened to be visiting the shop and saw the pennies from Pleasantville Heaven piling up.

Love That Logic

Chap we know just bought a Hotpoint air-conditioning unit. In filling out a card to return to the company, he answered the question, "Why did you select a Hotpoint?" with one word – "Hotweather."

Accessible Archives

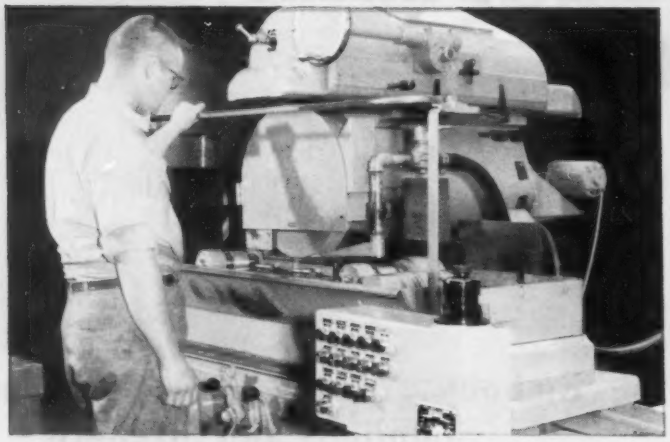
If you are looking for information on patents relating to welding, the A. F. Davis Welding Library at Ohio State University, Columbus, Ohio, can expedite your search. The library houses over 15,000 patents in a coded and classified file available to industry without charge. And for a nominal fee, the staff will search the files for you and forward patent numbers. The library also contains some 6000 books on welding, or fodder for solder, we'd say.

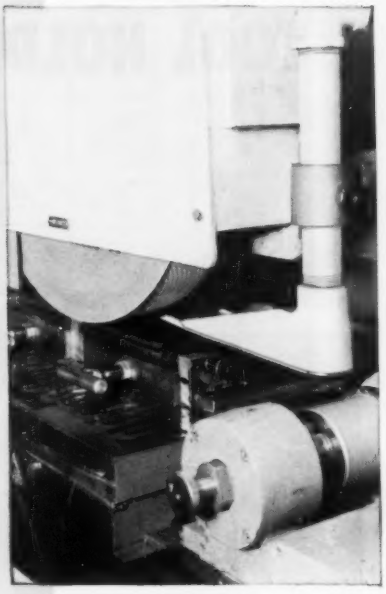
No Nostalgia Here

Nine rules of conduct, laid down by the proprietor of the Mt. Cory Carriage & Wagon Works in 1872, included several which would jolt today's workers, such as, "This office will open at 7 a.m. and close at 8 p.m. daily, except on the Sabbath"; "Men employes will be given an evening off each week for courting purposes, or two evenings a week if they go regularly to church"; and, "Any employe who smokes Spanish cigars, uses liquor in any form, gets shaved at a barber shop, or frequents pool or public halls will give me (the proprietor, who else?) good reason to suspect his worth, intentions, integrity, and honesty." Must have been some heavy courting going on.

CONGRATULATIONS, MR. POLK, OR TO BE PRECISE, DR. POLK—Louis Polk, president of the Sheffield Corporation, Dayton, Ohio, also director and group executive vice-president of Bendix Aviation Corporation (of which Sheffield is a subsidiary), received an honorary degree of doctor of science from Miami University on June 9 for his "contribution in advancing the arts of engineering, dimensional control, and metrology." Mr. Polk enjoys a key role in helping to provide industry with higher standards of accuracy in precision measurement. As a director and vice-president of the American Ordnance Association and chairman of its Dimensional Standards and Metrology Division, he has been instrumental in securing industry-government cooperation to split the inch to the seventh decimal place—0.0000001.

Thompson — TRUFORMING CUTS COSTS 66% ... DOUBLES PRODUCTION AND IMPROVES PRODUCT AT THE OLIVER CORPORATION





In the production of ledger plates, used in the cutter bar of mowing machines, The Oliver Corp. of Chicago, formerly first milled the teeth, then hardened the plate. The hardening process caused distortion and variance in uniformity which impaired the cutting action of the bar.

On the advice of Thompson engineers, a Type BB Truforming Grinder with a 2½" width grinding wheel was installed to process these ledger plates as a finished grinding operation. The plates are now heat treated first and the teeth are then formed by grinding.

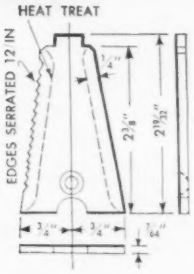
The installation of the Thompson Truforming Grinder has accomplished the following results:

1. **Cut total production costs from $3.18 to $1.06 per 100 pieces.**
2. **Increased the production rate from 1600 to over 3600 pieces per 8-hour shift.**
3. **Provided constant uniformity in the workpieces.**
4. **Eliminated the full-time service of one man.***
5. **A pair of $160.00 milling cutters formerly produced 20,000 pieces. A $60.00 grinding wheel now produces well over 40,000 pieces.**

The leadership of Thompson Truforming Grinders results from 25 years of research and development work in crush form grinding. Today these machines are opening up hundreds of practical, time-saving, profit-improving and cost-cutting applications for industry.

Thompson's engineering experience is available to you without obligation. Write for Catalog T558.

Automatic machine cycle allows operator time to countersink hole in plate—an operation formerly requiring one man's full time.



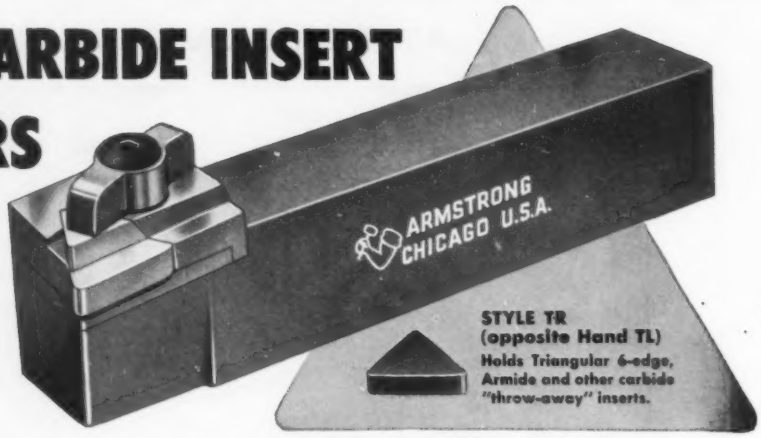
LEDGER PLATE
High Carbon Manganese Steel
Rockwell C52-58

"Keep Thompson in mind for that daily grind"

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO

Thompson SURFACE GRINDERS

New ARMSTRONG Armide CARBIDE INSERT TOOL HOLDERS



STYLE TR
(opposite Hand TL)
Holds Triangular 6-edge, Armide and other carbide "throw-away" inserts.

STYLE SR
(opposite Hand SL)
Holds square, 8-edge, Armide and other carbide "throw-away" inserts.

Embody . . . Convenience, Economy, Simplicity and Strength based on these superior features:

- **IMPROVED CLAMPING METHOD—speeds indexing of Inserts.**
- **REPLACEABLE SEAT of Hardened Tool Steel—protects shank and provides flat base to prevent damage to inserts as they are clamped in position.**
- **SHANK of Heat Treated Alloy Steel—gives extra strength and rigidity.**

NOTE: Carbide Inserts ground for use in negative rake tool holders have 8 or 6 usable edges. Those ground for use in positive rake tool holders have 4 or 3.

A slight turn of a single screw permits rapid indexing of the ARMIDE insert—reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts which are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883, for both positive rake, and for negative rake tool holders.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

The ARMSTRONG line of ARMIDE Carbide Insert Tool Holders offers both Positive rake and Negative rake tool holders in two shank styles both for conventional tool posts; for open side tool posts. Complete data on these tools is given in Bulletin CIT, mailed on request.

Buy ARMSTRONG TOOLS from your Industrial Distributor

Write for catalog

ARMSTRONG BROS. TOOL CO.

5213 W. ARMSTRONG AVENUE **CHICAGO 46, ILL.**

For more information fill in page number on Inquiry Card, on page 161

MINIMUM DIAMETERS OF MACHINE SPINDLES AT POINT OF MOUNTING FOR OVERHUNG WHEELS OF VARIOUS DIAMETERS AND THICKNESSES OPERATING AT SPEEDS UP TO 9,500 PERIPHERAL FEET PER MINUTE

Diameter of Wheel	Thickness of Wheel, Inches																		
	¼	⅜	½	⅝	¾	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	4	4½	5
	← Diameter of Spindle — Inches →																		
2	⅛	3/16	3/16	¼	¼	⅜	..	..	..	..	..	..	..	..	..	..	..	..	..
3	¼	¼	⅜	⅜	⅜	⅜	..	..	..	..	..	..	..	..	..	..	..	..	..
4	5/16	⅜	⅜	⅜	⅜	⅜	½	½	½	½	..	..	..	..	..	..	..	..	..
5	⅜	⅜	½	½	½	½	½	½	½	½	..	..	..	..	..	..	..	..	..
6	½	½	½	½	½	½	½	½	⅝	⅝	¾	¾	¾	¾	¾	¾	¾	¾	1
7	½	½	½	½	½	½	⅝	⅝	⅝	⅝	¾	¾	¾	¾	¾	¾	1	1	1
8	½	½	½	½	⅝	⅝	⅝	⅝	⅝	¾	¾	¾	¾	1	1	1	1	1	1
9	⅝	⅝	⅝	⅝	⅝	⅝	¾	¾	¾	¾	1	1	1	1	1	1	1¼	1¼	1¼
10	⅝	⅝	⅝	⅝	¾	¾	¾	¾	¾	¾	1	1	1	1¼	1¼	1¼	1¼	1¼	1¼
12	¾	¾	¾	¾	¾	¾	¾	1	1	1	1	1	1	1¼	1¼	1¼	1¼	1¼	1½
14	¾	¾	¾	¾	1	1	1	1	1	1	1	1¼	1¼	1¼	1¼	1¼	1½	1½	1½
16	..	..	..	..	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1½	1½	1½	1½	1½	1¾
18	..	..	..	..	1¼	1¼	1¼	1¼	1¼	1¼	1½	1½	1½	1½	1½	1½	1¾	1¾	1¾
20	..	..	..	..	..	1½	1½	1½	1½	1½	1½	1½	1½	1½	1¾	1¾	1¾	1¾	2
24	..	..	..	..	..	1½	1½	1½	1½	1½	1½	1½	1¾	1¾	1¾	1¾	2	2	2
26	..	..	..	..	..	..	1½	1½	1½	1½	1¾	1¾	1¾	1¾	2	2	2	2	2
30	..	..	..	..	..	..	..	1¾	1¾	1¾	1¾	1¾	2	2	2	2	2¼	2¼	2¼
36	..	..	..	..	..	..	..	..	2	2	2	2	2¼	2¼	2¼	2½	2½	2¾	2¾

Note: For speeds exceeding 9,500 peripheral feet per minute and for wheels with heavy mountings, (such as bolted-on abrasive discs) the spindle sizes shown in the above table are usually not adequate. Inasmuch as the proper spindle size is dependent upon many factors, such as general design of the machine, type of bearings, quality of materials and workmanship, a simple table is not practicable. Wheels larger than specified by the machine manufacturer should not be used on any given machine.

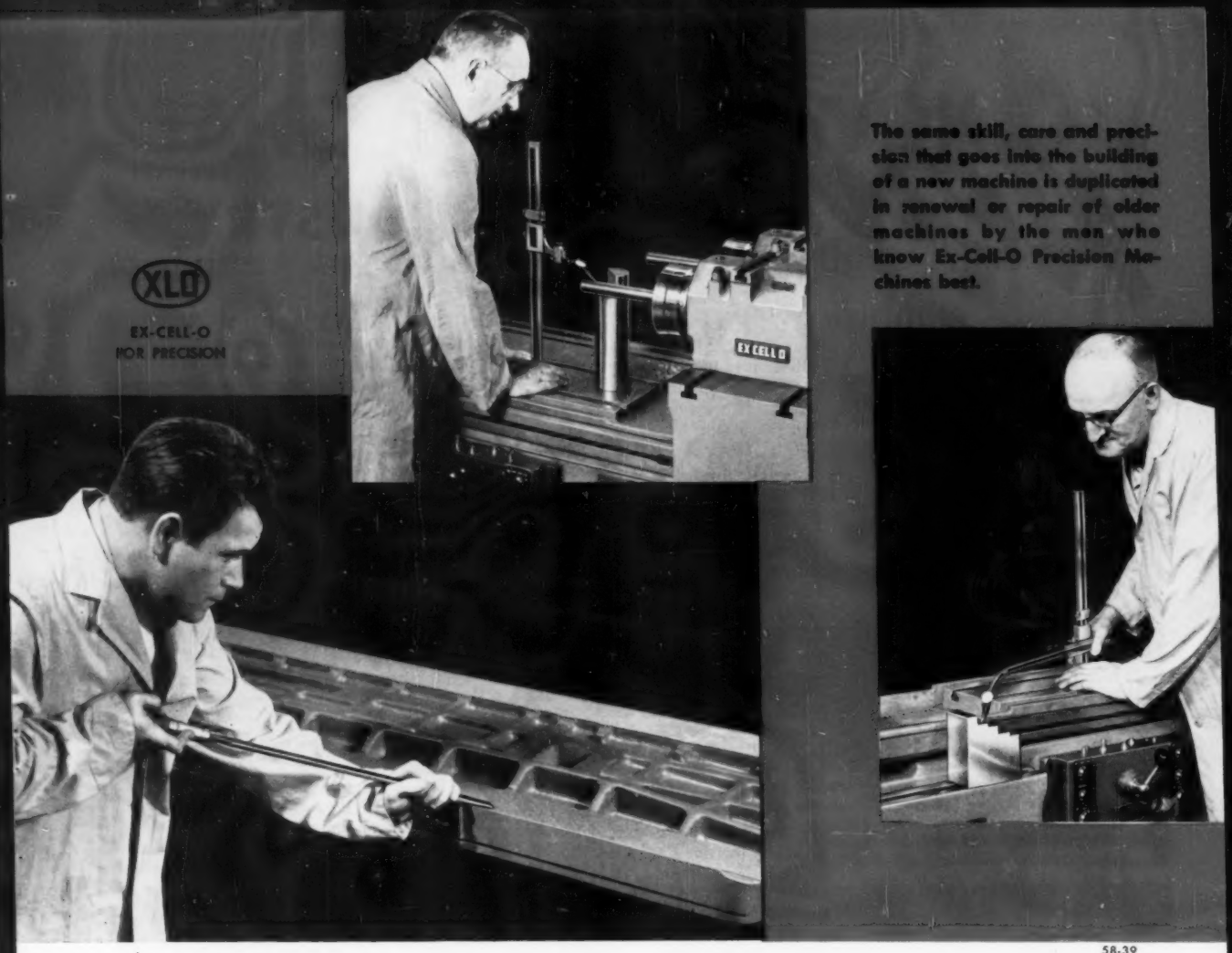
This table is reproduced from the American Standards Safety Code for the Use, Care, and Protection of Abrasive Wheels, B7.1-1956, copyrighted by the American Standards Association, 70 E. 45th St., New York 17, N. Y.

CONVERSION TABLE—WHEEL SPEEDS

REVOLUTIONS PER MINUTE FOR VARIOUS DIAMETERS OF GRINDING WHEELS TO GIVE PERIPHERAL SPEED IN FEET PER MINUTE AS INDICATED

Diameter of Wheel in Inches	Peripheral Speed in Feet per Minute																Diameter of Wheel in Inches
	4,000	4,500	5,000	5,500	6,000	6,500	7,000	7,500	8,000	8,500	9,000	9,500	10,000	12,000	14,000	16,000	
	Revolutions per Minute				Revolutions per Minute				Revolutions per Minute				Revolutions per Minute				
1	15,279	17,189	19,098	21,008	22,918	24,828	26,737	28,647	30,558	32,467	34,377	36,287	38,196	45,836	53,474	61,116	1
2	7,639	8,594	9,549	10,504	11,459	12,414	13,368	14,328	15,278	16,238	17,188	18,143	19,098	22,918	26,737	30,558	2
3	5,093	5,729	6,366	7,003	7,639	8,276	8,913	9,549	10,186	10,822	11,459	12,115	12,732	15,278	17,826	20,372	3
4	3,820	4,297	4,775	5,252	5,729	6,207	6,685	7,162	7,640	8,116	8,595	9,072	9,549	11,459	13,368	15,278	4
5	3,056	3,438	3,820	4,202	4,584	4,966	5,348	5,730	6,112	6,494	6,876	7,258	7,640	9,168	10,696	12,224	5
6	2,546	2,865	3,183	3,501	3,820	4,138	4,456	4,775	5,092	5,411	5,729	6,048	6,366	7,639	8,913	10,186	6
7	2,183	2,455	2,728	3,001	3,274	3,547	3,820	4,092	4,366	4,638	4,911	5,183	5,456	6,548	7,640	8,732	7
8	1,910	2,148	2,387	2,626	2,865	3,103	3,342	3,580	3,820	4,058	4,297	4,535	4,775	5,729	6,685	7,640	8
9	1,698	1,910	2,122	2,334	2,546	2,758	2,970	3,182	3,396	3,606	3,820	4,032	4,244	5,092	5,940	6,792	9
10	1,528	1,719	1,910	2,101	2,292	2,483	2,674	2,865	3,056	3,247	3,438	3,629	3,820	4,584	5,348	6,112	10
12	1,273	1,432	1,591	1,751	1,910	2,069	2,228	2,386	2,546	2,705	2,864	3,023	3,183	3,820	4,456	5,092	12
14	1,091	1,228	1,364	1,500	1,637	1,773	1,910	2,046	2,182	2,319	2,455	2,592	2,728	3,274	3,820	4,366	14
16	955	1,074	1,194	1,313	1,432	1,552	1,672	1,791	1,910	2,029	2,149	2,268	2,387	2,865	3,342	3,820	16
18	849	955	1,061	1,167	1,273	1,379	1,485	1,591	1,698	1,803	1,910	2,016	2,122	2,546	2,970	3,396	18
20	764	859	955	1,050	1,146	1,241	1,337	1,432	1,528	1,623	1,719	1,814	1,910	2,292	2,674	3,056	20
22	694	781	868	955	1,042	1,128	1,215	1,302	1,388	1,476	1,562	1,649	1,736	2,084	2,430	2,776	22
24	637	716	796	875	955	1,034	1,115	1,194	1,274	1,353	1,433	1,512	1,591	1,910	2,228	2,546	24
26	588	661	734	808	881	955	1,028	1,101	1,176	1,248	1,322	1,395	1,468	1,762	2,056	2,352	26
28	546	614	682	750	818	887	955	1,023	1,092	1,159	1,228	1,296	1,364	1,637	1,910	2,182	28
30	509	573	637	700	764	828	891	955	1,018	1,082	1,146	1,210	1,274	1,528	1,782	2,036	30
32	477	537	597	656	716	776	836	895	954	1,014	1,074	1,134	1,194	1,432	1,672	1,910	32
34	449	505	562	618	674	730	786	843	898	955	1,011	1,067	1,124	1,348	1,572	1,796	34
36	424	477	530	583	637	690	742	795	848	902	954	1,007	1,061	1,273	1,484	1,698	36
38	402	452	503	553	603	653	704	754	804	854	904	955	1,006	1,206	1,408	1,608	38
40	382	430	478	525	573	620	669	716	764	812	860	908	956	1,146	1,338	1,528	40
42	366	409	454	500	545	591	636	682	732	775	818	863	908	1,090	1,272	1,464	42
44	347	390	434	478	521	564	608	651	694	737	780	8[illegible]	868	1,042	1,216	1,388	44
46	333	375	416	458	500	541	582	624	666	708	750	791	832	1,000	1,164	1,332	46
48	318	358	398	438	478	517	558	597	636	676	716	756	796	956	1,116	1,272	48
53	288	324	360	395	432	468	503	539	576	612	648	683	720	864	1,006	1,152	53
60	255	287	319	350	387	414	446	478	510	542	574	606	638	774	892	1,020	60
72	212	239	265	291	318	345	371	398	424	451	477	504	530	637	742	849	72

Note: "Centrifugal Force," which is the force that tends to rupture a given wheel when overspeeding, increases as the square of the velocity of that wheel. For example, the centrifugal force in a wheel running at 5,500 surface feet per minute is 49 per cent greater than in the same wheel running at 4,500 surface feet per minute, although the speed is acutally only 22 per cent greater.



58-39

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News OF THE INDUSTRY

California and Colorado

LOUIS ALLIS CO., Milwaukee, Wis., announces the opening of augmented facilities for immediate product delivery, application engineering and service in the southern California area in a newly completed district office and warehouse building at 4405 E. Olympic Blvd., Los Angeles, Calif. GROVER BROWN will manage the new unified district function in Los Angeles with the assistance of ELMER MURRAY and MAX POLING, district engineers, and YALE MORGAN, office manager. Other West Coast offices are located at San Francisco, Seattle, Portland, Salt Lake City, and Phoenix.

WALLACE SUPPLIES MFG. CO., Chicago, Ill., announces a new service for West Coast buyers of its products. Under an exclusive distributorship arrangement with M. N. Thackaberry, Inc., 1300 S. Soto St., Los Angeles 23, Calif., the Wallace company offers its line to West Coast users.

LATROBE STEEL CO., Latrobe, Pa., announces that work has started in Los Angeles on its West Coast warehouse and office. Both facilities will be located at 2919 Tanager Ave., Los Angeles, Calif.

WHITMAN & BARNES, Plymouth, Mich., announce the moving of their Los Angeles branch to new quarters—5226 E. Washington Blvd.

MICHIGAN TOOL CO., Detroit, Mich., has announced the appointment of the F. J. LEONARD CO., Denver, Colo., as sales and engineering representative in the Rocky Mountain area for its products. The new representative maintains offices at 1219 California St., Denver, Colo. Its district covers sixty-three counties of Colorado, thirty-two counties of New Mexico, and twenty counties of Wyoming.

Illinois and Wisconsin

ILLINOIS TOOL WORKS, Chicago, Ill., have announced the establishment of a gear services department to function in cooperation with the company's Machine & Instrument Division to meet the increased needs of the gear industry for the higher standards of quality in gears and parts. Inquiries about any of the special services of this department may be addressed to Raymond W. Blakeman, manager, Machine & Instrument Division.

ROBERT B. NOREN has been promoted to sales manager, Special Products Division, Chicago Screw Co., Division of Standard Screw Co., Bellwood, Ill. He was in charge of special products sales for one of their territories.

CALVIN GAUBATZ has been appointed to head aluminum sales for Joseph T. Ryerson & Son, Inc., Chicago, Ill.

RAYMOND E. BREITUNG has been appointed sales manager of foundry products for the Kaukauna Machine & Foundry Division of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. He was formerly purchasing agent for the G & L and Hypro Division.

CUTLER-HAMMER INC., Milwaukee, Wis., has acquired AIRBORNE INSTRUMENTS LABORATORY INC., Mineola, N. Y. AIL will operate as the Electronics Division of Cutler-Hammer, retaining its name, officers, personnel, and line of business.

Michigan

VICKERS INCORPORATED, Detroit, Mich., has announced the following appointments: ARCHIE LAIRD, formerly sales application engineer in the Detroit office, has been appointed manager of the company's Atlanta, Ga., office. Mr. Laird has been with Vickers since 1952. GREGORY M. MCKEOWN has been appointed to the newly created position of branch operations manager, Machinery Hydraulics Division. Mr. McKeown joined Vickers in 1936, serving in numerous capacities in the organization.

BUHR MACHINE TOOL CO., Ann Arbor, Mich., announces the appointment of two additional distributors to handle its lines of machine tools. C. H. GOSIGER MACHINERY CO., Bacon and McDonough Sts., Dayton, Ohio, has been appointed to represent Buhr in southern Ohio and northern Kentucky. LAKESHORE MACHINERY & SUPPLY CO., 400 W. Laketon Ave., Muskegon, Mich., will represent them in western Michigan.

NEW YORK AIR BRAKE CO., Kalamazoo, Mich., has announced a change in name of its manufacturing division in Kalamazoo, Mich., to the "Hydreco" Division. The change is made to more closely associate the division with the trade name "Hydreco" carried by the industrial hydraulic equipment built at this plant.

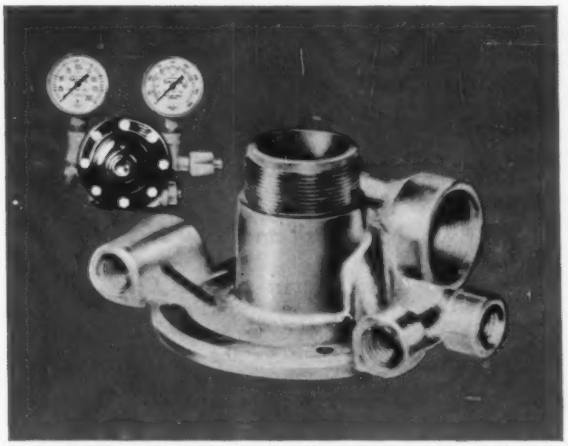
NEWCOMER PRODUCTS, INC., Latrobe, Pa., announces that MOORE & SPICER CO., operated by FRED A. MOORE, JR., and LEONARD M. SPICER, has been appointed their sales representative in the Detroit area. The newly appointed sales representative will operate out of the Newcomer Detroit branch office at 16455 Hamilton Ave., Detroit 3, Mich.

TOMKINS-JOHNSON CO., Jackson, Mich., has announced the construction of a new manufacturing plant and office facilities to be completed by the Fall of 1958. The new headquarters, located adjacent to Jackson, will approximately triple their present office and plant space.

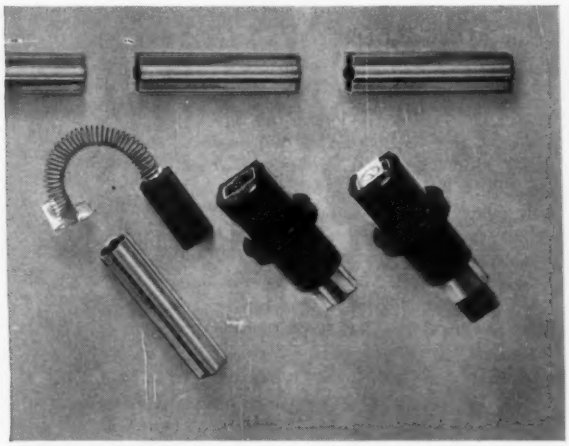
KARL P. HOCKENBERY has been appointed district sales manager of Metal Carbide Corporation, Youngstown, Ohio, for the Michigan area. His headquarters will be in the firm's district office and warehouse at 20485 Van Dyke St., Detroit, Mich.

MITCHELL P. KARTALIA has been appointed general manager of the Marketing Division, Square D Co., Detroit, Mich. Mr. Kartalia, who has been sales manager of the company's Distribution Equipment Division, will make his headquarters in the Detroit executive offices.

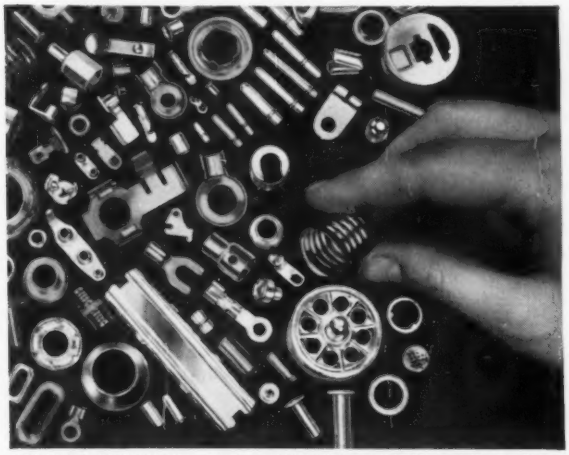
TAKE A FRESH LOOK at the way you are fabricating metal parts. Cost-cutting possibilities are almost unlimited with these Anaconda pre-formed mill products and press products.



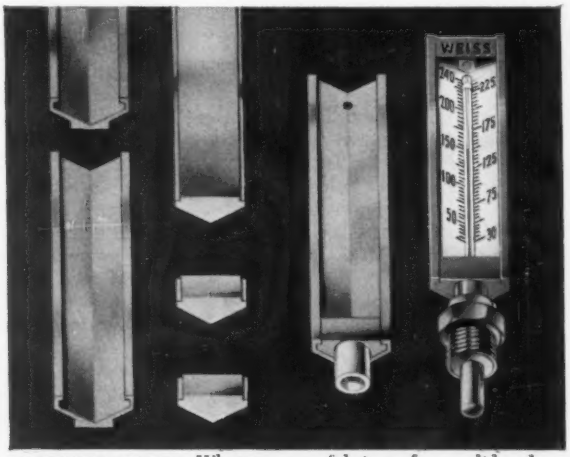
DIE-PRESSED FORGINGS, made of twice-wrought metal, offer superior uniformity, denseness, accuracy. *Savings*: replace more costly built-up assemblies—often are less in first cost than sand castings—require minimum surface machining to size—simplify secondary operations—lower tool cost—lower finishing cost.



SPECIAL-SHAPE TUBES can, as in the case of Electrolux, save several steps in arriving at a finished part. Brass electric-motor brush holder (above) is cut economically from long lengths of tube pre-shaped to accommodate both brush and spring. Uniform accuracy of all dimensions helps provide good brush stability.



MULTIPLE-PLUNGER AND PROGRESSIVE-TOOL-PRESS PRODUCTS are cutting costs throughout industry—often over 50%. Main reasons: The American Brass Company's complete design engineering service, long experience, specialized production equipment, a big selection of stock tools. Metals: copper, copper alloys, nickel, iron, steel, stainless steel, or aluminum.



EXTRUDED SHAPES. Wherever you fabricate from solid rod or bar—or castings—consider savings in machining, tooling and scrap by use of extruded shapes. Albert A. Weiss & Sons substituted two extruded shapes, above, for a sand casting—cut cost of thermometer case 41%, got an additional 30% saving in assembly because of consistently uniform dimensions.

HERE are four immediate approaches to cutting costs. Re-evaluate your designs and fabrication methods with these short cuts to finished products in mind. Wherever you spot a possible saving, send a sample, drawing, or description—with the quantity you need, the metal or properties you require—and ask for a quotation. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Limited, New Toronto, Ontario. 5863

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EXTRUSIONS · FABRICATED METAL GOODS

products of

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Made by The American Brass Company

New England

UNITED-GREENFIELD CORPORATION, Horton Chuck Division, New Haven, Conn., has announced a consolidation of its sales force. In all areas other than Cincinnati, Geometric and Greenfield men will take over as direct salesmen of Horton Chuck, replacing manufacturers' agents. In conjunction with the new sales setup, Horton has expanded its facilities to a recently completed plant in New Haven.

ELDORADO TOOL & MFG. CORPORATION, Milford, Conn., has announced the acquisition of two new sales representatives. BRAINARD & Co., 2324 Fourth Ave., Moline, Ill., will cover western Illinois and the entire state of Iowa. DEPENDABLE ENGINEERING SERVICE, INC., 4407 W. North Ave., Milwaukee, Wis., has been assigned the states of Minnesota, Wisconsin, and eastern Illinois.

The CUSHMAN CHUCK Co., Hartford, Conn., has appointed B. S. MEADE Co., Short Hills, N. J., to represent it in the following territory: Metropolitan New York and Long Island, including lower New York State; eastern Pennsylvania; the states of New Jersey; Delaware; Maryland; and the District of Columbia.

ROBERT A. WARFEL has been appointed vice-president and works manager of the Nelco Tool Co., Inc., Manchester, Conn. Nelco Tool Co. is the carbide manufacturing subsidiary of Cutting Tool Division, Brown & Sharpe Mfg. Co.

Robert A. Warfel, vice-president and works manager, Nelco Tool Co.

GEORGE F. DUN has been named technical assistant to the executive vice-president of Emhart Mfg. Co., Hartford, Conn. Mr. Dun previously was plant manager of Emhart's Automatic Packaging Machinery Division, Standard-Knapp, Portland, Conn.

BAY STATE ABRASIVE PRODUCTS Co., Westboro, Mass., announces two promotions. FRED C. STOCKINGER, currently West Coast district manager, will be transferred to the company's home office to assume new duties as assistant sales manager on September 1, 1958. He will assist ELDEN L. AUKER in administration of Bay State's nation-wide grinding wheel sales organization. Mr. Auker is vice-president, marketing. ROBERT F. KELLEHER will assume the duties of West Coast district manager, replacing Mr. Stockinger.

COMMERCIAL FILTERS CORPORATION, Melrose, Mass., a subsidiary of Ogden Corporation, has acquired the Industrial Filtration Company, manufacturers of "Delpark" Filters. Delpark will operate as a part of Indiana Commercial Filters Corporation with headquarters in Lebanon, Indiana.

SACO-LOWELL SHOPS, Boston, Mass., have elected THOMAS J. AULT to the presidency of their firm. MALCOLM D. SHAFFNER, former president, was recently elevated to board chairman, succeeding DAVID F. EDWARDS, now honorary chairman.

JAY D. SHERMAN, former district manager of the Reed-Prentice branch office in New York City, has been promoted to field sales manager of the Reed-Prentice Division of Package Machinery Co., East Longmeadow, Mass.

FRANK P. WISEBURN has been appointed Chicago district manager for Union Twist Drill Co., Athol, Mass.

RICHARD A. LOWE has been appointed sales manager for the Baldwin-Lima-Hamilton SR-4 Products Group, Electronics & Instrumentation Division, Waltham, Mass.

BROWN & SHARPE MFG. CO., Providence, R. I., has announced the following personnel changes: WILLIAM A. MCGREGOR has been assigned as general manager of Brown & Sharpe, Ltd., Plymouth, England, commencing September 1. He previously was manufacturing manager of the Industrial Products Division at the Providence plant. EARL P. LEEDS, who has been general manager of the Brown & Sharpe, Ltd., English plant for several years, will shortly return to Providence as director—federal government sales, reporting to the Machine Tool Division. THOMAS C. ROBERTS will become manufacturing manager, Industrial Products Division. He is presently director of manufacturing engineering, Machine Tool Division. LESTER J. CORSER will succeed Mr. Roberts as director of manufacturing engineering. He is now assistant to the group superintendent of the milling and grinding group of the Machine Tool Division.

New York and New Jersey

AIR REDUCTION SALES CO., a division of Air Reduction Co., Inc., New York City, has dedicated its new facility for the production of liquid oxygen, nitrogen, and argon at South Acton, near Boston, Mass. The new air separation and liquefaction facility is the first of its kind to be built in New England. The Air Reduction plant at Acton is the fifth modern air separation and liquefaction facility to be constructed by the company in recent years. Similar plants have already been completed at Butler, Pa.; Riverton, N. J.; Chicago, Ill.; and City of Industry, near Los Angeles, Calif.

FAIRMONT ALUMINUM CO., Fairmont, W. Va., wholly owned subsidiary of CERRO DE PASCO CORPORATION, New York City, has elected HARLEY T. PYLES and W. BRADLEY BLAIR to the posts of vice-president and treasurer, and vice-president—sale, respectively. Mr. Pyles has been a director and treasurer of Fairmont since 1940. Mr. Blair joined the company as a metallurgist in 1943.

RUSSELL, BURDSALL & WARD BOLT AND NUT CO., Port Chester, N. Y., has announced the following personnel changes: WILLIAM HERMAN SCHMIDT has been named plant superintendent at the Port Chester plant after serving four years in that capacity in the company's Los Angeles plant. Replacing him as plant superintendent at Los Angeles is OLOF V. JOHNSON, formerly machine-shop supervisor.

J. JUSTIN BASCH has been appointed to the new position of marketing vice-president of Oakite

J. Justin Basch, recently appointed marketing vice-president of Oakite Products, Inc.

Products, Inc., New York City. Mr. Basch, formerly vice-president for research and product development, will now be reponsible for sales, engineering, advertising, and marketing research as well.

JOHN W. BELANGER has been appointed general manager of the General Electric Co.'s Apparatus Sales Division, Schenectady, N. Y. Mr. Belanger, a General Electric vice-president, succeeds the late WILLIAM V. O'BRIEN, who died June 21. Mr. Belanger joined the General Electric Co. in 1917 as a student engineer at Lynn, Mass., and has served the firm in many capacities since then.

A. I. NUSSBAUM has been appointed vice-president of Loma Machine Mfg. Co., Inc. and its affiliate company, Lobeck Casting Processes, Inc., New York City.

C. E. "CLIFF" POST has been appointed eastern regional sales manager of the Tool & Wheel Division, American Coldset Corporation, Teterboro, N. J.

Ohio

AMERICAN SOCIETY FOR METALS, Cleveland, Ohio, announces that its Board of Trustees has appointed ADOLPH O. SCHAEFER, president, Pencoyd Steel & Forge Corporation, Philadelphia, Pa., to the unexpired term of secretary of the Society following the recent death of founder-member WILLIAM H. EISENMAN, who for forty years had served as national secretary. RAY T. BAYLESS, long-time assistant secretary of the Society, will continue in this position and will become, in addition, temporary manager, to direct activities at the headquarters offices. Five ASM staff members appointed to an advisory council were: A. P. FORD, EVELYN G. GARDNER, TAYLOR LYMAN, ERNEST E. THUM, and CHESTER L. WELLS.

HILL ACME CO., Cleveland, Ohio, has announced the appointment of two new representatives. The McBETH MACHINERY CO., 300 Mt. Lebanon Blvd., Pittsburgh, Pa., and the PENINSULAR MACHINERY CO., 19178 James Couzens Highway, Detroit 35, Mich., have recently been appointed exclusive agents for their respective territories. The appointment of the McBeth Machinery Co. in the Pittsburgh territory now supplements its former appointment in Philadelphia and permits coverage of the entire states of Pennsylvania and West Virginia, as well as small portions of adjoining territories. The Peninsular Machinery Co., Detroit, Mich., now covers the western half of lower Michigan.

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, announces two appointments: E. D. VANCIL, manager of Meta-Dynamics Division, was elected vice-president of the parent organization, the Cincinnati Milling Machine Co. L. E. EBERTS, assistant export manager, was elected vice-president of Cincinnati Milling's sales subsidiary, Cincinnati Milling and Grinding Machines, Inc.

MOTCH & MERRYWEATHER MACHINERY CO., Cleveland, Ohio, has announced its acquisition of the Wink Cutter Division of the F. J. FINK & CO. At the beginning of this year Motch & Merryweather consolidated its Cleveland manufacturing operations and sales headquarters in its expanded factory and office at its Euclid plant, where Wink equipment will be produced. FRANK J. FINK is joining Motch & Merryweather as manager of the Wink Cutter Division.

EUGENE G. BATES has been appointed Southern District sales manager for the Steelweld line of press brakes, heavy metal-cutting shears and straight-side presses of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

LINCOLN ELECTRIC CO., Cleveland, Ohio, has made the following appointments: JOHN F. KOTCHIAN, CHARLES M. RICHARDSON, and WILLIAM F. FISCHER have been made district managers of the company's North Haven, Conn., Franklin, Pa., and Phoenix, Ariz., offices, respectively.

ZAGAR, INC., Cleveland, Ohio, has announced that a contract has been awarded for a 10,000-square-foot extension to the company's present site. This expansion provides a 50 per cent increase in office area and allows a closer integration of sales and engineering departments.

GARCO MACHINERY, INC., Cleveland, Ohio, has been appointed to represent the FOSDICK MACHINE TOOL CO., Cincinnati, Ohio, in northern Ohio.

(Left) E. D. Vancil, vice-president, Cincinnati Milling Machine Co., and (right) L. E. Eberts, vice-president, Cincinnati Milling and Grinding Machines, Inc.



(Left) Jack T. Welch, vice-president in charge of field sales; (center) William I. Wilt, vice-president, Gage and Instruments Division; (right) Victor J. Boll, assistant vice-president of Contract Manufacturing Division of Sheffield Corporation

SHEFFIELD CORPORATION, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation, announces four promotions: JACK T. WELCH was appointed vice-president in charge of field sales and WILLIAM I. WILT was named vice-president, Gage and Instruments Division. VICTOR J. BOLL was promoted to assistant vice-president of the Contract Manufacturing Division. THOMAS W. CLARK of Grosse Point, Mich., was promoted to assistant vice-president of the Service Facilities Division.

JAMES PETERSON has joined the Cyril Bath Co., Solon, Ohio, as chief engineer.

Pennsylvania

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., has announced that all metals research, development, and metallurgical activity will be combined in a new technology department. The department will be headed by DR. M. J. DAY, vice-president – technology, formerly vice-president – research and development. D. I. DILWORTH, JR., director of metallurgy, will assume broadened responsibilities in the new department, including direction and coordination of metallurgical policies, standards, and procedures, etc. The company has also announced two other appointments in the technology department. W. E. GREGG has been named director of technical development and DR. W. L. FINLAY, director of research. Mr. Gregg, previously works manager–Titanium Division, will coordinate new product and process activities throughout the company and manage patent and license activities. Dr. Finlay, former manager–Midland Research Laboratory, will be responsible for steel, titanium, and special alloys research.

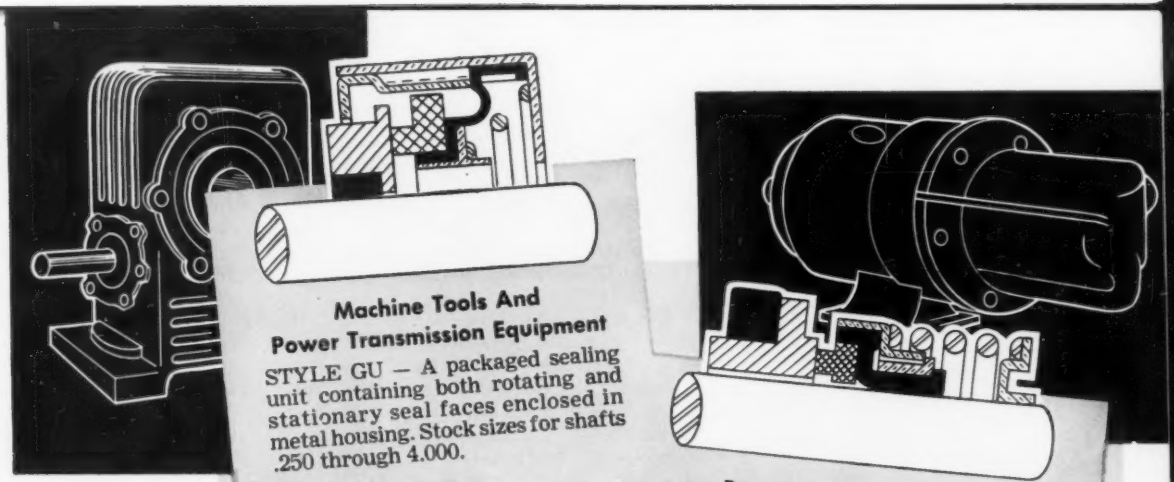
CARPENTER STEEL CO., Reading, Pa., has appointed W. KENT KISE, JR., as metallurgist in the special alloys development group. Mr. Kise will assist in the development of Carpenter alloys for electronic, magnetic, and electrical applications. JAMES O. PEALE has been appointed manager of distributor sales, with headquarters at the company's home office in Reading. He will act as product manager to the non-exclusive stainless distributor customers.

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa. announces two new appointments. WILLIAM R. HOWELL has been made assistant to the vice-president–operations, with offices at company headquarters in Pittsburgh. He was formerly works manager at the firm's Midland, Pa., works. GEORGE M. BURRIER will assume the position of works manager at Midland, replacing Mr. Howell.

RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, Ohio, announces that the Voss ENGINEERING CO., Pittsburgh, Pa., has signed an agreement with it by which it becomes a national distributor of Reliance-designed tracer control. The Voss Engineering Co. is located at 7301 Penn Ave., Pittsburgh 8, Pa.

WERNER PFLUG has been appointed vice-president of the National Carbide Die Company of McKeesport, Pa.


(Left) William R. Howell, assistant to the vice-president-operations and (right) George M. Burrier, works manager, Midland, Pa., Crucible Steel Company of America



Machine Tools And Power Transmission Equipment

STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.

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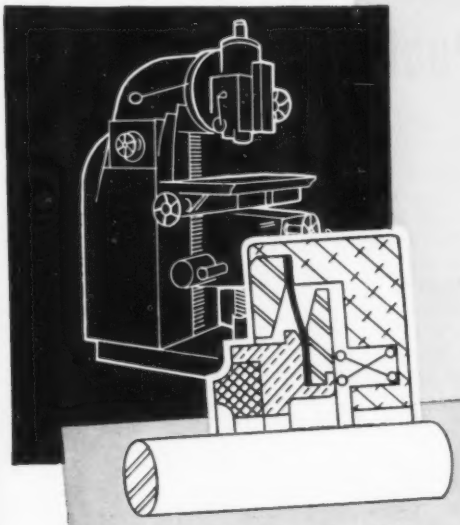
ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.



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STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

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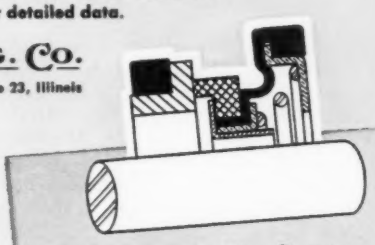
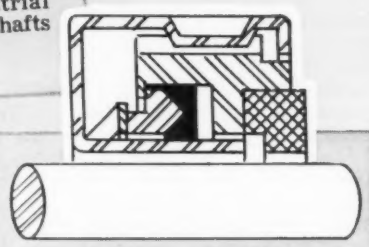
Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century



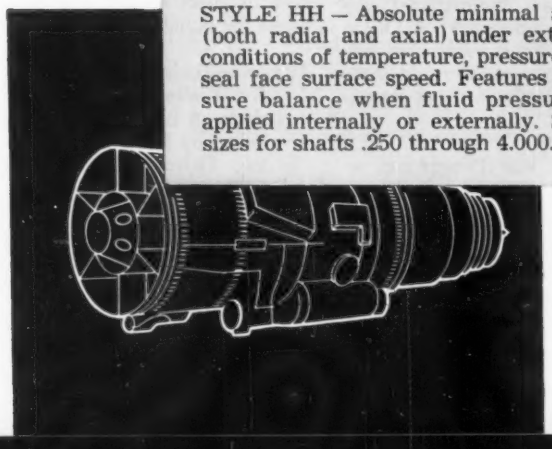
Household Appliances

STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.



S. L. Crawshaw, vice-president, Philadelphia Gear Corporation

S. L. CRAWSHAW has been elected as a vice-president of Philadelphia Gear Corporation, Philadelphia, Pa. Mr. Crawshaw, who joined the firm in 1955, will direct its new high-precision gear grinding activities.

Texas and Virginia

CURTIS A. JOHNSTON has been appointed machine tool sales representative in Dallas for the Oliver H. Van Horn Co., Inc., Fort Worth, Tex.

HEINZ V. MENKING has been named general director of product development for Reynolds Metals Co., Richmond, Va. Mr. Menking formerly was director of the transportation section of the product development department.

Coming Events

SEPTEMBER 23-26—Association of Iron and Steel Engineers' 1958 Iron and Steel Exposition and Convention will be held in Public Auditorium, Cleveland, Ohio. The Association's address is 1010 Empire Building, Pittsburgh 22, Pa. The managing director: T. J. Ess; exposition manager: William C. Friesel.

SEPTEMBER 29-OCTOBER 3—American Society of Tool Engineers' Semi-Annual Meeting and Western Tool Show will be held at Shrine Exposition Hall, Los Angeles, Calif. Exposition committee: Leonard Abrams, ASTE, 10700 Puritan Ave., Detroit 38, Mich.; Harry E. Conrad, executive secretary.

OCTOBER 27-29 — Semi-annual meeting of AMERICAN GEAR MANUFACTURERS' ASSOCIATION at the Edgewater Beach Hotel, Chicago, Ill. For further information contact Association Headquarters, One Thomas Circle, Washington 5, D. C.

OCTOBER 27-31 — National Metal Exposition and Congress will be held at the Cleveland Public Auditorium, Cleveland, Ohio. The same week the annual meeting of the AMERICAN SOCIETY FOR METALS, the SOCIETY FOR NONDESTRUCTIVE TESTING, and the AMERICAN INSTITUTE OF MINING, METALLURGICAL, AND PETROLEUM ENGINEERS—INSTITUTE OF METALS DIVISION, will be held. For further information contact American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. Adolph O. Schaefer, secretary.

DECEMBER 1-5—Twenty-Third Exposition of Power and Mechanical Engineering will be held at the Coliseum, New York City. For further information, contact International Exposition Co., 480 Lexington Ave., New York 17, N. Y. E. K. Stevens, manager.

New Books and Publications

WELDING HANDBOOK. Edited by Arthur L. Phillips. 560 pages; 420 illustrations; 6 by 9 inches. Published by the American Welding Society, 33 W. 39th St., New York 18, N. Y. Price, $9.

This handbook is appearing in a new format. It is divided into five sections and one section will be published each year for the next five years. This first section deals with the fundamentals of welding: Standard welding, terms, basic welding, metallurgy, design, inspection, statistical control, etc. It is designed to be interpretive as well as factual. Manufacturers, researchers, and practical men have all contributed to the volume. A comprehensive bibliography is included at the end of each chapter for those seeking further information on a given subject.

SET-UPS ON AUTOMATICS. (No. 41 in the Yellow Back Series). 76 pages, 5 1/8 by 8 1/2 inches. Published by Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, 75 cents.

At the recent international machine-tool exhibition held at Olympia, London, some interesting setups on automatics were demonstrated and details of these are recorded in this book.

PRINCIPLES OF THE PROPERTIES OF MATERIALS. By Jacob Porter Frankel. 228 pages; 6 by 9 inches. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price, $6.

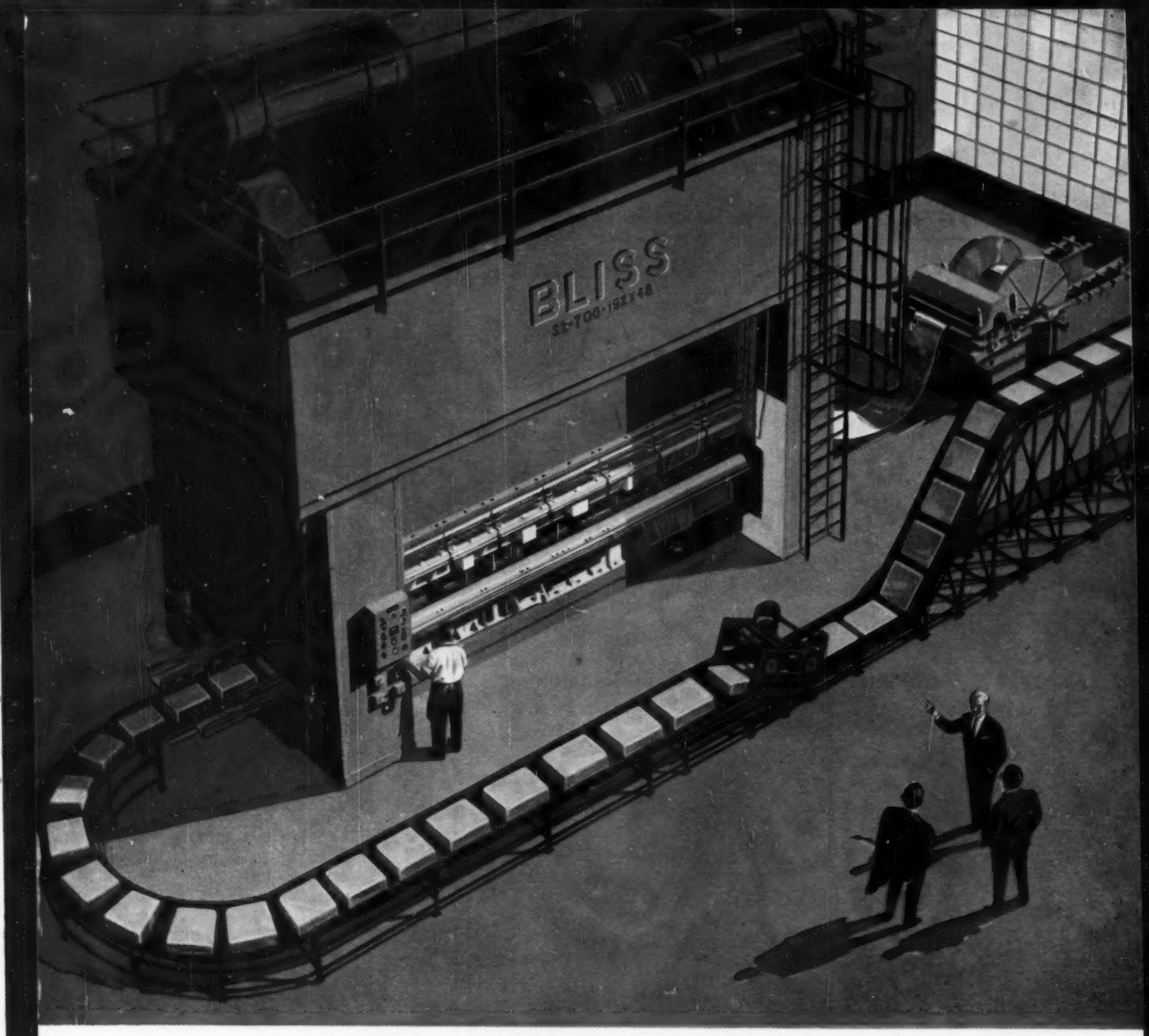
This study of the properties of materials takes a new approach to the subject by emphasizing principles and properties rather than materials. In order to enable the student to master the fundamentals of study heretofore available in scattered form in advanced texts and published papers, only the most important properties are considered. However, the underlying principles of physics of matter are presented in a way that should make it easy for the student to progress.

PLASTICS MATERIALS HANDBOOK. By Alan B. Glanville. (No. 40 in Yellow Back Series). 67 pages, 5 1/8 by 8 1/2 inches. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, 75 cents.

This text is a concise reference of the principal plastics materials, giving their physical, mechanical, and electrical properties; forms, colors, applications, decoration, cementing, etc. The data applies to plastics available in the form of moldings or manufactured forms for fabrication such as sheet or rod, and to other forms for industrial use.

TURNING—Tools, Methods, Costs. By Walter G. Holmes. 235 pages; 8 1/2 by 11 inches. Published by Reed Technical Service, Detroit 4, Mich. Price, $7.50.

A compendium of the author's knowledge of turning operations, based on his many years of experience in leading automotive manufacturing plants.



"We get ten refrigerator pans a minute...

from one press and with one attendant!" From its motorized coil cradle to its mechanized conveyer, this is a truly automated production unit. Coil stock feeds through the press' seven transfer stations...is easily formed and drawn into deep drawn refrigerator pans. Bliss engineers design and build entire systems like these, including the dies.

Can a transfer feed press work for you? Best way to find out is to ask—ask the people who introduced them in the nineties and have pioneered in their improvement since. Or send for new, case history-packed brochure.

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PRESSES • ROLLING MILLS • ROLLS • DIE SETS • CAN MACHINERY • CONTRACT MFG.

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

ABRASIVES, Disc
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

ACCUMULATORS, Hydraulic
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic—Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

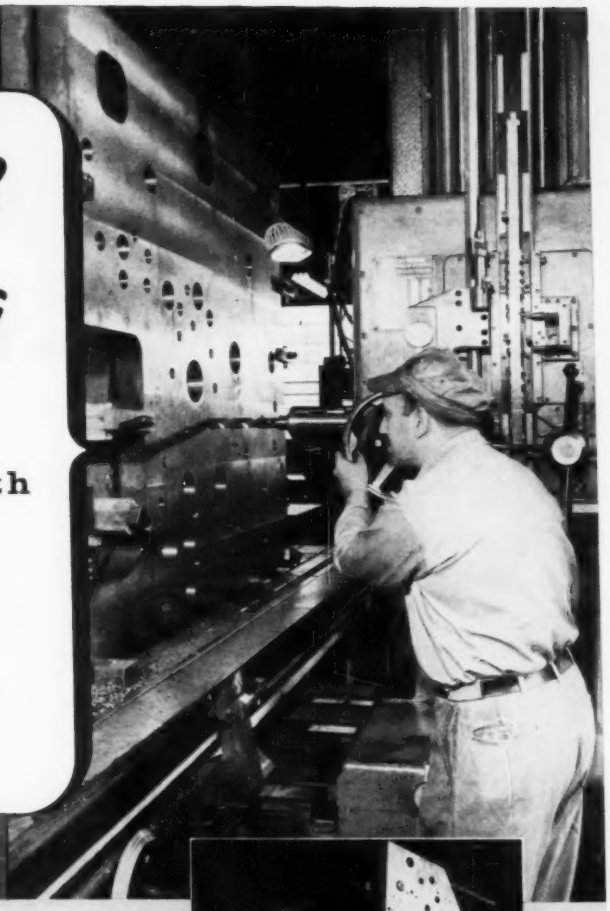
ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.

Automatic Positioning

Reduces
Production Costs with

BULLARD

H.B.M.
MODEL 75



The experience of George Hantscho Company, Inc., Mount Vernon, New York, builders of equipment for the printing industry, is typical of that enjoyed by users of Bullard H.B.M., Model 75.

THE PROBLEM

To bore 105 holes, from 5" to ½" in diameter, in both side frames of paper folding machine to support rollers, gears and folding cylinders. Some holes must be aligned vertically and others horizontally.

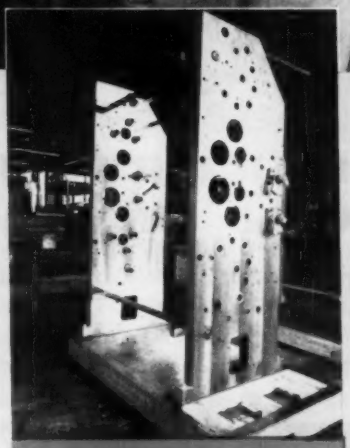
THE SOLUTION

Mount pair of side frames, ⅝" apart, on table of 4" Bullard H.B.M., Model 75, equipped with automatic table and head positioning. Bore all holes of the same size beginning with the largest and working down to the smallest.

THE ADVANTAGES

All related holes in perfect alignment — no spoilage. Less tool change-over time.

Eliminate hand measurements and templates for hole location. Accurate automatic hole location within a tolerance of ±.0004". Ease of operation from Pendant Control — less operator fatigue. Overall boring time reduced 25% over previous method.



Partially assembled side frames ready for ink rollers, gears and printing cylinders.

How about your boring problems? Are you applying all the advantages of a Bullard H.B.M., Model 75 to them? If not — get the full story from your nearest Bullard Sales Engineer or write

THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

ARC WELDERS—See Welding Equipment, Arc

ASSEMBLING MACHINES

Detroit Power Screwdriver Co., 2799 W. Fort St., Detroit 16, Mich.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

AUTOMATIC SCREW MACHINES—See Screw Machines, Single and Multiple-Spindle Automatic

AUTOMATION EQUIPMENT

Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

BABBITT

Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BALANCING EQUIPMENT

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALLS

Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Hoover Ball & Bearing Co., Ann Arbor, Mich.

BAR MACHINES—See Screw Machines, Single and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous

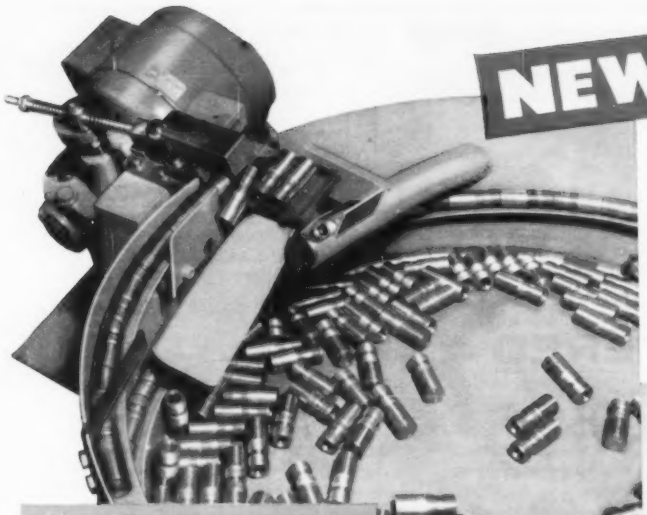
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Mueller Brass Co., Port Huron, Mich.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BAR STOCK AND SHAFTING, Steel

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BEARING PILLOW BLOCKS AND CARTRIDGES

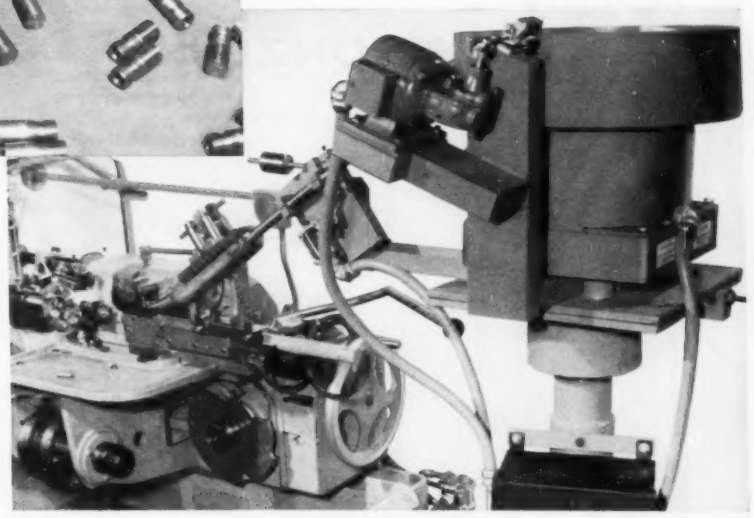
Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Fafnir Bearing Co., New Britain, Conn.



NEW

BROWN & SHARPE
AUTOMATIC HOPPER FEEDER
for second operation work

CUTS LOADING TIME MORE THAN 50%



OPERATION

1. Workpieces are dumped in hopper.
2. High-frequency vibration of hopper causes pieces to climb spiral shelf along inside wall of hopper.
3. At top of spiral, pieces are tipped into mouth of tube leading to turret.
4. Sorting baffle at tipping mechanism rejects pieces approaching "wrong-end-forward."
5. Hopper vibration and flow of parts stops automatically when tube is full; starts automatically when more parts are needed.
6. Escapement at bottom end of tube synchronizes delivery of each piece to receptacle mounted in one port of turret, as it indexes to receiving position.
7. Receptacle grips piece, carries it 180° and delivers it to opened collet in spindle.
8. Collet closes and holds piece during required operations.
9. Collet opens and piece is ejected just before new workpiece is delivered by receptacle.

Automatic sorting and piece loading for B&S Automatics* permits added operations in a shorter cycle . . .

The new Brown & Sharpe Automatic Turret Loading Attachment takes the "slow-down" out of second operation work. Loading requires only normal turret indexes plus constant insertion time — as little as half the time required for other methods, such as cross slide chute loading.

All cross slides are available for tooling, and, for most jobs, five turret positions. More operations can be performed in a shorter time cycle.

Big savings in operator's time are assured, since feeding is fully automatic after parts are dumped in the hopper. Net production from machines equipped with these hopper feeders compares directly with production from machines on bar work with automatic bar loading.

A standard, self-contained device, the Automatic Turret Loader requires a minimum of special parts. Normally, changeover to accommodate another type part requires less than 30 minutes.

Find out how this arrangement can lower your second-operation costs. Send samples and prints for application study and report. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

*__Model__ shown for use with new design B&S No. 2 Automatic Screw Machines only — capacity up to 1¼" diameter and 4¼" maximum length. Models to fit other sizes of B&S Automatics will be available soon.

PROGRESS IN PRECISION FOR 125 YEARS

Brown & Sharpe B·S

MILLING, GRINDING, AND SCREW MACHINES • MACHINE TOOL ACCESSORIES • PRECISION TOOLS • HYDRAULIC PRODUCTS • CUTTERS

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Ball & Roller Bearing Co., Danbury, Conn.
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio

BEARINGS, Needle

Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio.

BEARINGS, Oilless

Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BEARINGS, Roller

Ball & Roller Bearing Co., Danbury, Conn.
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio

BEARINGS, Thrust

Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio

BELT SANDERS—See Grinding Machines, Abrasive Belt

BENCH CENTERS

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENDERS, Bar, Tube, Channel, etc.

Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

For more information fill in page number on Inquiry Card, on page 161

NEW from Standard Oil

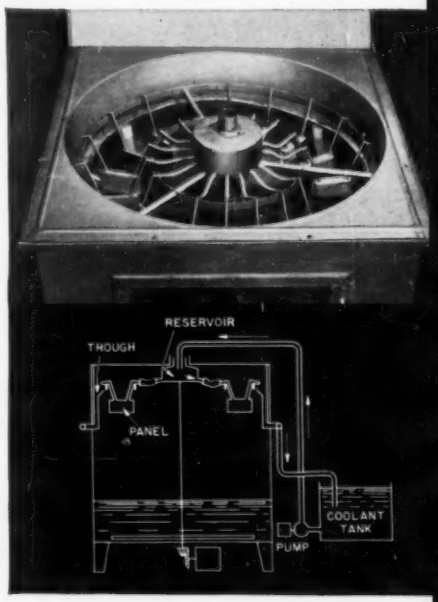
THE MAGIC BOX

Corrosion steals $5.5 billion from industry annually. Standard Oil is in the forefront of the fight to control this loss. Standard's research scientists have developed a new method for measuring the effectiveness of rust preventives. This new test takes less than one-twentieth of the time of previous tests—and is about three times as precise.

Using a controlled humidity cabinet for testing corrosion, these Standard research men installed a system for cooling metal test panels (previously treated with rust preventive) so that their surface temperatures are lower than the temperature in the cabinet. Temperatures of panel surfaces and of cabinet atmosphere are held accurately. Controlling the temperature of the panels controls the rate at which water condenses on them. This in turn (for the first time) permits accurate control of the amount of condensation on the panels. Rust preventives are more speedily and precisely tested. Science, as a result of this work, has a new tool with which to test corrosion.

This is the research pay-out industry receives from Standard Oil. This is the something extra that backs up the Standard industrial lubrication specialist who calls on you. This is the something extra found in the products he sells.

To know more about how Standard Oil industrial lubrication specialists—and Standard's research program—can help you, call the Standard Oil office nearest you in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.**



Top view and cross section of Accelerated Condensation Corrosion Test cabinet.

You expect more from STANDARD and get it!

Edgar A. Dieman, Standard Oil scientist, inventor of new Rust Preventive System, inspects metal panel that has undergone test in the humidity cabinet.

BENDERS, Plate, Etc.

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Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

BENDING MACHINES, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDING ROLLS

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BLAST CLEANING EQUIPMENT

Pangborn Corp., Hagerstown, Md.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

BLUING LAYOUT

Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

BOLTS, NUTS AND SCREWS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Northwestern Tools, Inc., 115 Hollier Ave., Dayton 3, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOOKS, Technical

Industrial Press, 93 Worth St., New York 13, N. Y.

BORING BARS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Kennametal Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.

(*Continued on page 208*)

RECEIVING ENTHUSIASTIC ACCEPTANCE

VICKERS® New ¼" Temperature and Pressure Compensated FLOW CONTROL VALVE

ANOTHER VICKERS FIRST

FOR OPERATING PRESSURES UP TO 2000 psi

For years the Machine Tool Industry has been asking for a combination Temperature and Pressure Compensated Flow Control Valve to minimize feed rate changes. Now for the first time it is available as a production unit at a reasonable price.

Check THESE EXCLUSIVE FEATURES that mean Optimum Tool Life and Better Work Finish:

TEMPERATURE COMPENSATED
Virtually constant feed rates all day long with same throttle setting because throttle automatically compensates for changes in oil temperature. The compensator mechanism is simple in design and durable.

PRESSURE COMPENSATED
Constant feed rate throughout entire cycle because built-in pressure hydrostat automatically compensates for load changes.

SINGLE THROTTLE COMPLETE RANGE ADJUSTMENT
Greater flexibility because valve is adjustable within entire flow range of 5 to 1000 cubic inches per minute.

REVERSE FREE FLOW AS STANDARD FEATURE
A standard feature which permits reverse free flow (up to 1400 cu. in. per min.) from outlet to inlet port by-passing control elements.

TAMPER-PROOF ADJUSTMENT
Retension of original feed rate is assured because a set screw prevents inadvertent throttle movement and a cover over the set screw can be locked in place.

INTERCHANGEABLE
This new valve replaces 12 previous models and it is interchangeable with all of them, also the drain connection is eliminated on the new valve to simplify piping.

GREATER ECONOMY
No need to stock several valves for wide range of flow rates. Drain connection is eliminated, piping costs are reduced.

MAXIMUM RELIABILITY AND ACCURACY
Design of temperature and pressure control components assures maximum circuit reliability and extreme accuracy of feed through a range of 5 to 1000 cubic inches per minute.

FOR ADDITIONAL INFORMATION SEND FOR I-195040 8143

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Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1403 • Detroit 32, Michigan

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

For more information fill in page number on Inquiry Card, on page 161

Universal Engineering Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio
Wesson Co., 120 Woodward Heights Blvd., Detroit 20, Mich.

BORING HEADS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N.Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette St., Detroit 9, Mich.
Wales-Strippit Co., Akron, N. Y.

BORING MILLS, Horizontal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.

(*Continued on page 210*)

For more information fill in page number on Inquiry Card, on page 161

By investing dollars wisely . . .

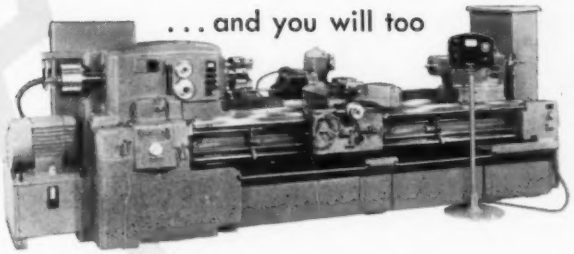
and meshing Monarch Air-Gage Tracer Dyna-Shift Lathes into the production line . . .

this quality gear maker

Cuts Turning Costs over 50%

Monarch
TURNING MACHINES

. . . and you will too



Let Western Gear people tell you how their investment is paying off—quickly!

(The following statements were all made voluntarily by shop men of Western Gear Corporation's Lynwood Works, Lynwood, California.)

A. "We combine know-how with the finest equipment to machine 'impossible' tolerances in production line quantities. Standard machinery just will not do the job.

"On one job the metal involved was nitralloy and our standard lathes required 30 minutes. With the MONARCH Dyna-Shift lathe, we produce the same part in only 6 minutes, an 80% reduction of production time."

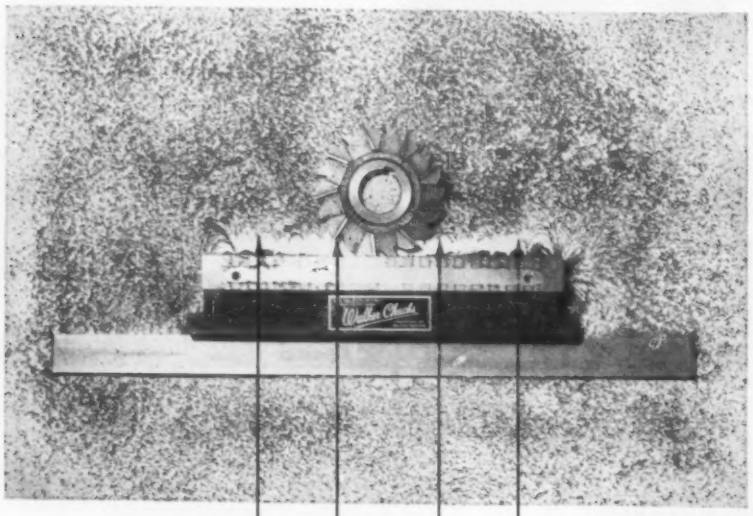
B. "In another instance, our standard machine required 75 minutes to machine one part, as compared to only 40 minutes on a MONARCH lathe. Production rejects on standard lathes averaged 7% to 8% on these parts (turned from 4140 steel) . . . but we've almost eliminated rejects on the MONARCH lathes, saving as much as 50% on material costs on some parts."

C. "The manufacture of gears to total composite errors of .0005", and tooth-to-tooth errors of .0002", is an everyday occurrence here. MONARCH lathes have enabled us to maintain these tolerances virtually eliminating rejects and reducing production time per unit by a drastic margin."

D. "The MONARCH tracer is a production machine capable of turning out different diameter sizes in lots from 100 to 500 pieces and up from the template . . . yet it does the job without variation, and the only detectable changes occur because of the tool wear."

Isn't it time you investigated the greatest combination in lathes to date—the MONARCH Preselector Dyna-Shift with Air-Gage Tracer? Write for our new booklet No. 2609. It's loaded with many examples of Air-Gage Tracer savings.

The Monarch Machine Tool Company, Sidney, Ohio



(Unretouched photo)

Here's POSITIVE PROOF

...that WALKER Ceramic Magnet Chucks Eliminate Cutter Clogging and Chip Carryback

Now, for the first time, you can perform milling operations on workpieces held by magnetic chucks, with *minimum* clogging of the cutter, *minimum* carryback of chips into the cut, for trouble-free cutting.

The new Walker Ceramic Magnet Chuck, with magnets polarized *horizontally*—an exclusive construction feature—keeps the cutter constantly *demagnetized* as it progresses. As shown by the white area in the above magnetograph, the magnetic force is where it should be—confined to the top of the chuck for maximum holding. There are no lines of magnetic force extending upward to magnetize the cutter.

In addition to this extremely important feature, Walker permanent chucks offer a great many other advantages.

For example:—

- The ceramic magnets used have many times the coercive force of alloy magnets.
- Uniform holding throughout because of ¼" bar poles.
- All steel top plate. *No* soft insulating material is used.
- Less than half the weight of previous permanent chucks.
- All magnetic fields are neutralized to prevent magnetism of machine table or ways.

Walker permanent chucks with ceramic magnets are available in a complete range of sizes, 6x10", 6x12", 6x18", 8x24", 10x15". Write today for Catalog 58.

O.S.WALKER COMPANY, INC.

WORCESTER 6, MASSACHUSETTS, U.S.A.

The Original Designers and Builders of Magnetic Chucks

Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING TOOLS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Apex Tool & Cutter Co., Inc., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Ford du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BRAKES, Press and Bending

Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Ferracute Machine Co., Bridgeport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BROACHING MACHINE, Internal

American Broach & Mch. Co., Ann Arbor, Mich.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati, Ohio.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

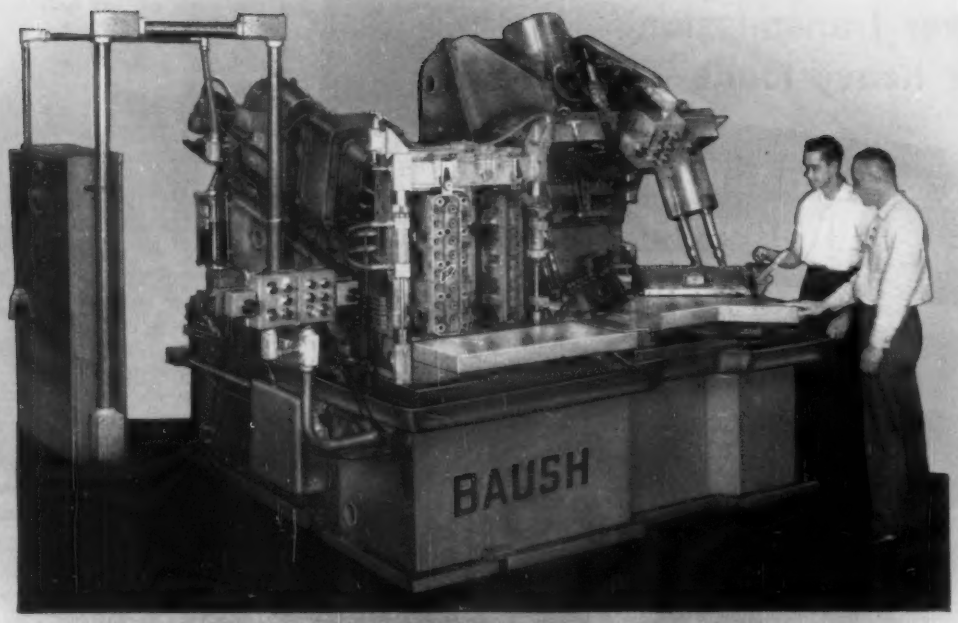
BRONZE

American Brass Co., Waterbury 20, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.

Smooth, quiet

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.

Delta Power Tool Div., 400 N. Lexington Ave.



Special *Two Way* Baush Features Model "S" Mechanical Leadscrew Unit...

in machine designed to end-mill and tap angular spark plug holes in cylinder head.

Speeding production of cylinder heads for a large motor producer this Baush machine completes 40 cylinder heads every hour. Production men are finding that Model "S" Mechanical Leadscrew units cut spoilage of parts with steady, clean cutting, as well as increasing production through less downtime and quicker starting.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

SPECIFICATIONS:

Welded steel base of this machine has chip conveyor running through it. At the left is the angular Model "S" Mechanical Leadscrew Unit which has a 4-spindle fixed center head arranged to end-mill holes.

At the right is a stationary angular Tapper with 4-spindle individual leadscrew fixed center head for tapping spark plug holes. This four position permanent-type fixture is hydraulically operated, electrically interlocked, and fixture hydraulically clamps part in position.

Full Trabon Lubrication system is used, with Mist Lubrication for tapping. The four motors and electrical controls are to J.I.C. standards.

We'll gladly help solve YOUR machine tool problems — just send along your specifications. There is no obligation.

For more information fill in page number on Inquiry Card, on page 161

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS, Metalforming
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

BURNISHING MACHINES
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Corbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools, Machinists' Small Tools

CALIPER, Vernier
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASTINGS, Die

American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Pittsburgh Brass Mfg. Co., 3199 Penn Ave., Pittsburgh 1, Penna.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS—Gray Iron, Malleable

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CASTINGS, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.

CEMENT, Abrasive Disc

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

CENTER-DRILLING MACHINES

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
La Salle Tool Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES—See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe

Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Houston Grinding & Mfg. Co., Inc., Houston 8, Texas
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKING MACHINES, Single-Spindle Automatic

Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter and Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

PRECISION BORING

with no rejects

SAVE 300 HOURS PER UNIT

on precision boring of gear boxes. Each unit (2 halves) calls for over 200 holes from ¾" to 4½" dia. Boring, spot facing, recessing, milling, tapping and counter boring. Material is aluminum alloy.

hole location accurate to ±.0001"

hole sizes repeated to ±.0001"

Boring time reduced from 800 hours to 500 hours per unit—with no rejects in all 50 parts—and every one accurate to ±.0001" on hole size and location! Over 200 holes per unit are machined.

Mr. R. Schmidt of Triangle Tool Co., Union, N. J., owner of this Fosmatic Jig Borer, reports, "Two Fosmatic features were largely responsible for this important time saving. First, the Fosmatic's long table travel permitted machining two parts at once. Second, the automatic positioning and Direct Dimension Measuring System work simply and fast. They eliminate confusion and help the operator work accurately and efficiently. Incidentally, that long table travel helped get us several new jobs we could never have handled on our other jig borer."

With Direct Dimension Measuring the operator sets dimensions direct from blueprint onto two direct reading drum dials. At the press of a button, the table automatically positions work to ±.0001". On the Fosmatic, this operation and all other machine functions can be numerically controlled by punched tapes or cards.

Fosmatic Jig Borers bring you many important advances in boring technology. Where progress has been so great, the obsolescence of your old machine may be more costly than you suspect. *Why not run a check?* Call your Fosdick Distributor or write us today.

Ask for Fosmatic Jig Borer Bulletin JB-M

CHUCKS, Combination Universal-Independent

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.

CHUCKS, Independent

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.

Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., 806 Windsor St., Hartford. 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Walker, O. S. Inc., Worcester, Mass.

CHUCKS, Power Operated

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety

Jacobs Mfg. Co., West Hartford 10, Conn.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.

(*Continued on page 218*)

ONLY T-J REAMERS

offer quality you can *TOSS AWAY*

...and still realize savings up to 50%

Expendable quality . . . can cut your replacement costs *more than half* by using the new T-J Reamers with throw-away heads. Only the quickly installed head, made of highest quality cutting steel, need be replaced after buying original shank.

T-J Reamers are available in a wide range of interchangeable heads from ½" to 2¾" inclusive, in 1/16" increments with right or left hand spiral flutes for thru or blind hole reaming. Heads are locked in place with newly designed locknuts to insure concentricity and true, flawless reaming. Write to Tomkins-Johnson Company, 617 North Mechanic Street, Jackson, Michigan, for Reamer Catalog No. 153-2 and full particulars.

T-J TOMKINS-JOHNSON

DIVISIONS: AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHERS

Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

CHUCKS, Universal Three-Jaw
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment

CLEANERS, Metal
Oakite Products, Inc., 26 Rector St., New York, N. Y.

CLUTCHES
Cleveland Punch & Shear Works, Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Dynamatic Div. Eaton Mfg. Co., Kenosha, Wis.
Minster Mch. Co., Minster, Ohio.

COLD HEADING
Hassall, John, Inc., Westbury, L. I., N. Y.
National Machinery Co., Tiffin, Ohio

COLLETS—See Chucks, Collet

COLLOIDAL GRAPHITE
Acheson Colloids Co., 2150 Washington Ave., Port Huron, Mich.

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air
DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 883, Dayton 1, Ohio.
Starrett, L. S., Co., Athol, Mass.

COMPARATORS, Optical
Bausch & Lomb Optical Co., Rochester, N. Y.
DoAll Co., 54 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

For more information fill in page number on Inquiry Card, on page 161

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BTR blanking die trims costs of power mower parts

This is part of a blanking die, made of BTR tool steel, which was manufactured recently by American Machine & Tool Co., Minneapolis, for use in forming a sheet-steel foot rest for a power mower.

"We first discussed the job with Paper Calmenson and Company, Bethlehem's local tool steel distributor," said one of American's engineers. "Their recommendation was BTR . . . because it's safe-hardening, tough, and has plenty of resistance to wear. It was a good choice. The die performed well, and our costs were kept low."

BTR (Bethlehem Tool Room) is our general-purpose, manganese-chromium-tungsten grade of oil-hardening tool steel. Time after time it gives long service, and trims down those production costs. That's why manufacturers keep coming back for more, and for a wide range of applications.

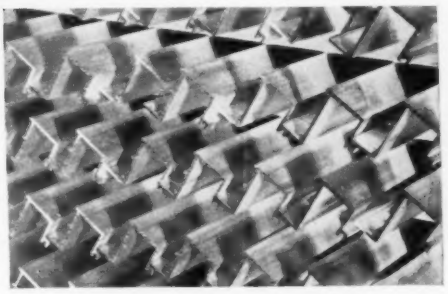
If you haven't yet experienced the advantages of BTR in your shop, why not order enough for a trial run from your Bethlehem tool steel distributor? It's one of the wisest moves you can make. Give him a call right now, while you have it in mind.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Letter Stamping Should Be Avoided

Many tools are stamped with number or letter die-stamps for identity, or to incorporate such information as size. But stamped impressions introduce sharp notches which serve to concentrate stresses both in the hardening operations and in service, and cause many service failures which would not have occurred in the absence of stamping. It is impossible to predict which stamped characters will cause trouble due to cracking. Often identical stamped tools develop little or no cracking through stamped characters, while duplicate lots may show a high percentage of such cracking.

Avoiding the use of stamped characters in tools and dies will be found to improve the service life, if a statistically large group of tools is studied. This result does not always occur on single tools, nor on a small number of tools. Yet there is no doubt that the elimination of stamping benefits tool life. In the light of present-day knowledge of the effects of stress concentration, it is intolerable that such stress-raisers as stamp marks be put on tools and dies intentionally. Stamping of characters can be avoided by resorting to the use of paint, labels, etching, or "electric pencil" to place the necessary information on the tool surfaces.



PATTERN IN EXTRUSIONS. These long metal extrusions, made by American Aluminum Extruders, Miami, were formed with a die of Cromo-WV. This grade, with its .30 pct vanadium content, is a modification of Cromo-W, our general purpose hot-work steel. Cromo-WV is an excellent tool steel grade for extrusion work because it has a well-balanced combination of properties: wear resistance, red hardness, and shock resistance, plus resistance to heat-checking.

COMPRESSORS, Air
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

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Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Van Keuren Co., Watertown, Mass.

CONTROLLERS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.

CONTROL SHAFTS—See Lead-screws & Splines, Ball Bearing

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes, W. F. & John Co., Rockford, Ill.

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American Brass Co., 25 Broadway, New York N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

COUNTERS
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CUTTERS, Keyseating
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
DoAll Co., Des Plaines, Ill.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling
Apex Tool & Cutter Co., Inc., Shelton, Conn.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Cincinnati Milling Products Div., Cincinnati, Ohio.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., Des Plaines, Ill.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

For more information fill in page number on Inquiry Card, on page 161

NEW all-welded box frame construction

NEW heavier, more rigid tool guide post

NEW automatic tool welder

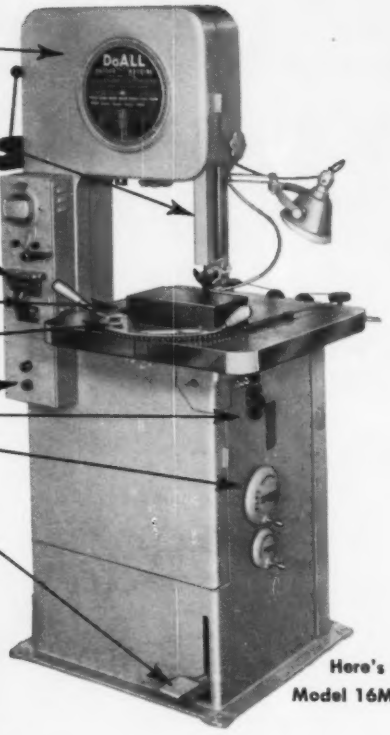
NEW heavy-duty drive—wide, stepless speed range

NEW precision-ground, non-glare, tilting table

NEW "job-tested" attachments

NEW easy-to-reach controls

NEW smooth, positive feed control



Here's the Model 16M (16")

NOW READY
2 new models

For Less Than $1000

You Can Own a Genuine DoALL Contour Machine

Now, at substantially lower prices, DoALL offers two new band machines—with the quality features and performance that defy competition. They have 16″ and 30″ throat and 12″ thickness capacity.

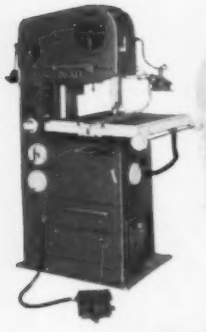
They're true multi-purpose machines—ideal for toolrooms, jobbing shops, sheet metal and maintenance shops. These new machines bring you the rigidity, power and operating ease that make DoALL the leader in the field.

With the Models 16M and 30M you are ready to handle a variety of assignments. In addition to sawing, the machines provide band filing, polishing, and friction cutting.

Entirely new, inside and out, these are modern, efficient, universal band machines. Variable-speed drive delivers smooth power for contour sawing of any machinable material. And accuracy is assured under even the heaviest cuts.

Let these new DoALL models help you beat rising costs. Ask for a free demonstration. Phone your local DoALL store. Or write for Bulletin 58-34.

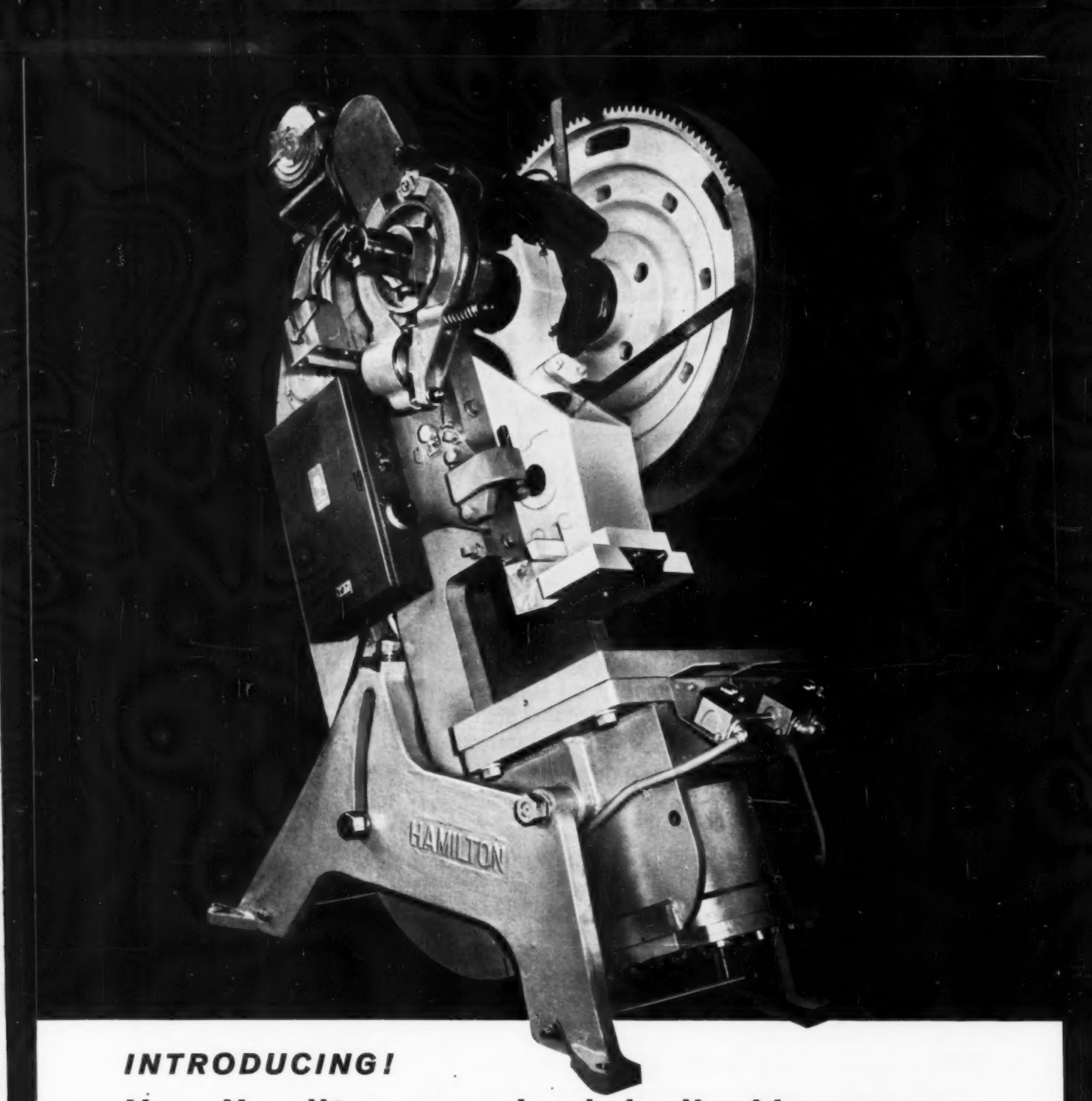
B-52



For high production DoALL offers its Contour-matics® teamed with Demon® HSS saw blades

THIS IS A TYPICAL DoALL STORE

DoALL The DoALL Company
Des Plaines, Illinois



INTRODUCING!

New Hamilton open-back inclinable presses

Special features of Hamilton OBI Presses include stress-relieved welded steel design — lowers deflection so that up to 50% more stampings can be produced before dies require regrinding; disc-type air clutch, mounted on the crankshaft, to permit low-inertia starting with reduced heat generation; special air-released, spring-actuated brake for maximum efficiency and production speed with low heat loss; extreme stability and wearing qualities made possible by a wrist pin and crosshead type connection.

Write to Dept. 3-H for Bulletin 13302

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Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Pa.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Material

CYLINDERS, Air
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.

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Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

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Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

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Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Lufkin Rule Co., Saginaw, Mich.

DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

DIE CUSHIONS
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Minster Mch. Co., Minster, Ohio
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

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Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Wales-Strippit Co., Akron, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

DIE STOCKS—See Stocks and Dies

DIES, Blanking, Forming, Drawing, Extruding, etc.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell St., Chicago 8, Ill.
Utz, Georg, Zurich, Switzerland
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Lettering and Embossing
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

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Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

DRAWING COMPOUNDS
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.

DRESSERS, Grinding Wheel
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio

DRIFT KEYS
DoAll Co., Des Plaines, Ill.

DRILL HEADS, Multiple Spindle
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Delta Power Tool Div., 400 N. Lexington Ave., Milwaukee 10, Wis.
Hartford Special Machinery Co., 387 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILL HEADS, Unit Type
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Snow Manufacturing Co., Bellwood, Illinois

DRILL SLEEVES AND EXTENSION HOLDERS
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Automatic Tool Co., Richmond, Ind.
National Twist Drill & Tool Co., Rochester, Mich.

DRILLING ATTACHMENTS, Multiple Spindle—See Drill Heads, Multiple Spindle, and Vises, Machine

DRILLING AND BORING UNITS, Self-contained
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Leland-Gifford Co., Box 989, Worcester 1, Mass.

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National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Automatic

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
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Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Edlund Mchry. Co. Div., Cortland, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit Corp., Akron, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Bench

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homesteaa Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.

DRILLING MACHINES, Deep Hole

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Ex-Cell-O Corp., 1200 Oakmon Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
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Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

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American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

DRILLING MACHINES, Sensitive

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Leland-Gifford Co., Box 989, Worcester, Mass.
Levin & Son, Inc., Louis, 3610 So. Broadway, Los Angeles, Calif.

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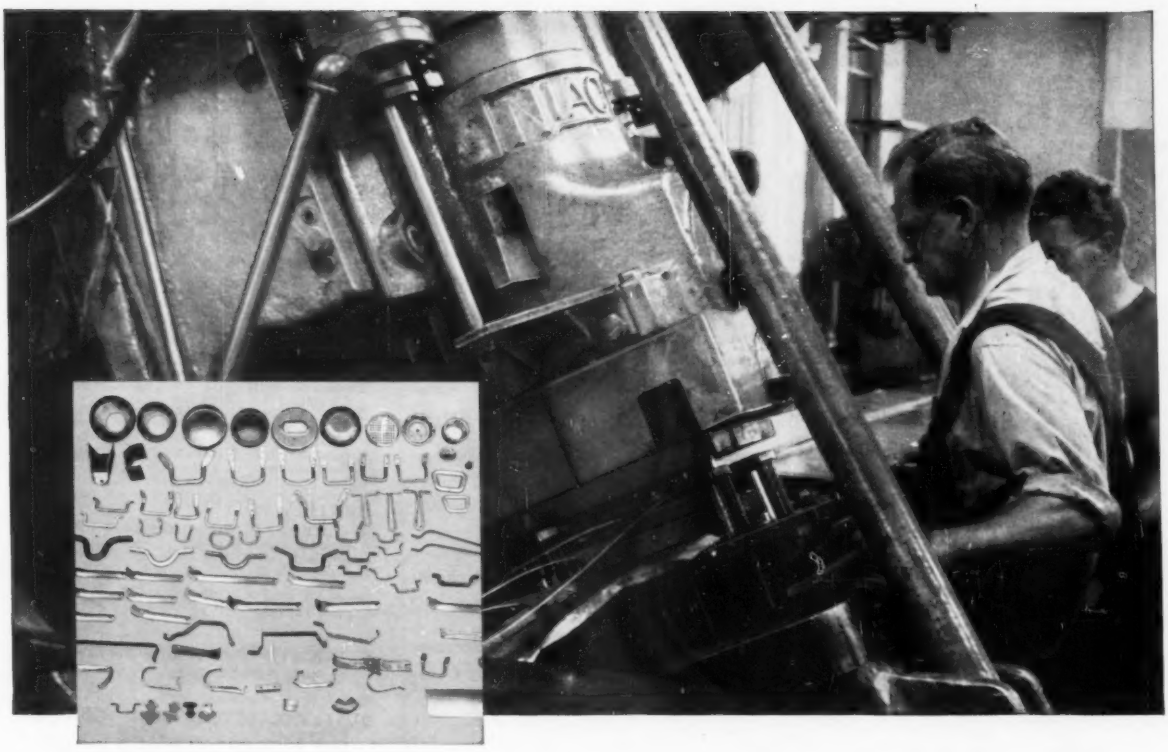
National Automatic Tool Co., Inc., S. 7th and



"We stamp them all using just 2 Cities Service Oils!"

Presses shift to numerous operations without ever changing oil, thanks to versatility of the 2 Cities Service oils used for all jobs.

Handles by the thousands are produced by Res for cooking utensils and similar items. Finish is excellent, thanks to Cities Service oil.

...says Res Manufacturing Company Milwaukee, Wisconsin

It's doubtful if anyone makes a more diversified line of stamped and formed metal products than Res Manufacturing Company.

With its 21 presses, ranging from 15 to 200 tons capacity, Res turns out millions of articles a year . . . wire handles, metal handles, wire forms, drawn shells, lifting loops, and parts for electrical controls, to mention just a few.

"All require the best possible finish and all get it with the use of just two Cities Service oils," says Assistant Plant Manager Herbert W. Krueger.

"For drawing, shaping, and punching aluminum, we use Cities Service Chillo #2 with excellent results. Where drawing, swedging or forming of steel and brass is required, we use Cities Service Chillo 12 and get equally fine results.

"Not only do these two Cities Service oils handle all our jobs and produce the best possible finish, but we also find they increase tool life and hold scrap to a minimum. In short, these are the best oils we have ever seen."

Like Res Manufacturing, chances are your operation can be simplified with the right Cities Service oils. Talk with a Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

For more information fill in page number on Inquiry Card, on page 161

Hassall, John Inc., Westbury, L. I., N. Y.

National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Universal Radial
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

DRILLING MACHINES, Upright
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
LeMaire Tool & Mfg. Co., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit Corp., Akron, N. Y.

DRILLS, Center
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

DRILLS, Core
Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

DRILLS, Deep Hole, Gun
Ace Drill Corp., Adrian, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Oil Hole, Oil Tube
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Portable Electric
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Portable pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Ratchet
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio

DRILLS, Subland
Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Twist, High-Speed Steel, Carbon Steel
Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Twist, Carbide, Carbide-Tipped
Ace Drill Corp., Adrian, Mich.
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Wire
Ace Drill Corp., Adrian, Michigan
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio

DUPLICATING ATTACHMENTS—See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio

ELECTRICAL DISCHARGE MACHINES—See Disintegrators

ELECTRONIC CONTROL SYSTEMS
Electronic Control Systems, 2231 S. Barrington Ave., Los Angeles 64, Calif.

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

EXPANDERS, Mechanical, Hydraulic
Grotnes Machine Wks., Inc., 5454 N. Walcott, Chicago 40, Illinois

EXTRACTORS, Screw
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

FACING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div. Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FASTENERS
Allen Mfg Co., 133 Sheldon St., Hartford 2, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.

Hassall, John Inc., Westbury, L. I., N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

FEEDERS, Automatic
Gear-O-Mation Div., Michigan Tool Co., 7171 McNichols Rd., Detroit 12, Mich.
V & O Press Co., Hudson, New York

FILES, Band
DoAll Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoAll Co., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary
DoAll Co., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Indiana Commercial Filters Corp., P. O. Box 271, Lebanon, Ind.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FLAME-HARDENING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

FORGING MACHINES, Headers, Upsetters, Presses
Ajax Mfg. Co., 1441 Chardon Rd., Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W. Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
National Machinery Co., Tiffin, Ohio

FORGING, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron, Mich.

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Wyman-Gordon Co., Worcester, Mass.

FORGINGS, Ferrous, Aircraft and Missiles
Cameron Iron Works, Inc., 1000 Silber Rd., Houston, Tex.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
U. S. Steel Corp., Pittsburgh, Pa.

FORGINGS, Upset
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.

FORMING MACHINES, Cold-Rolling
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.

(Continued on page 230)

Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima- Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North Main St., Ampere, E. Orange, N. J.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator

Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Automatic Sorting

Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Saginaw, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric Comparator

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Grinding

Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper Telescoping Thickness

Brown & Sharpe Mfg. Co., Providence, R. I.

GAGES, Multiple Inspection

Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Van Keuren Co., Watertown, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Roll Thread Snap, Adjustable Snap

Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

GAGES, Surface Roughness

DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

GEAR BURNISHERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHECKING EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Bevel and Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS

American Schiess Corp., 1232 Penn. Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

GEAR HONERS

National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

GEAR LAPPERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

GEAR MOTORS—See Speed Reducers

GEAR RACKS

Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

GEAR SHAPERS

Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR SHAVERS

Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

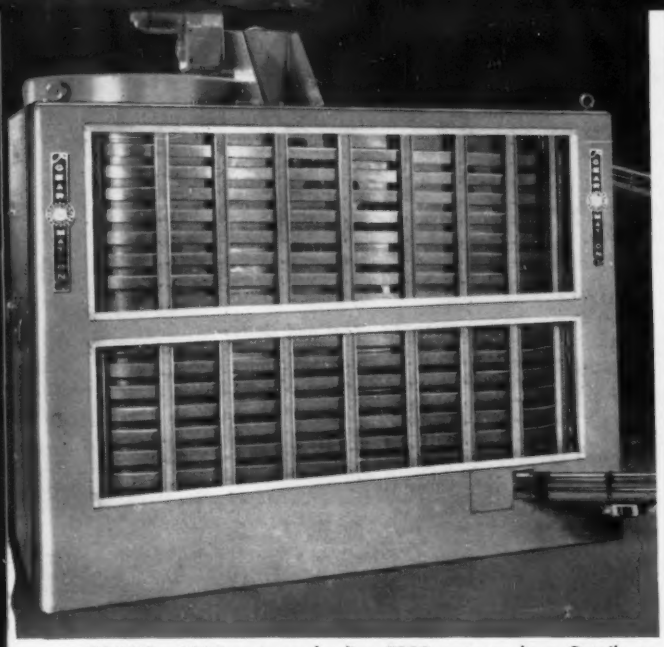
GEARS, AND GEAR BLANKS, Nonmetallic

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
New Jersey Gear & Mfg. Co., Hillside, N. J.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

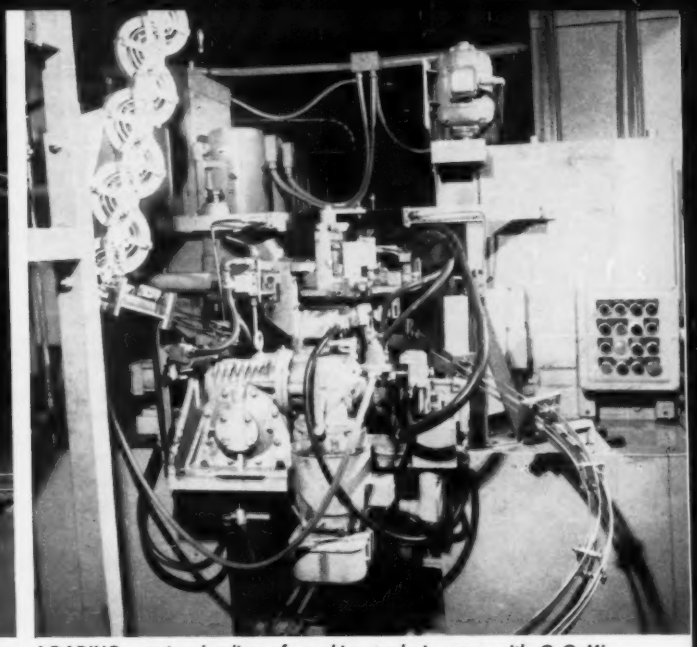
GEARS, Cut

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefedorf Gear Corp., Box 934, Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio

(*Continued on page 232*)

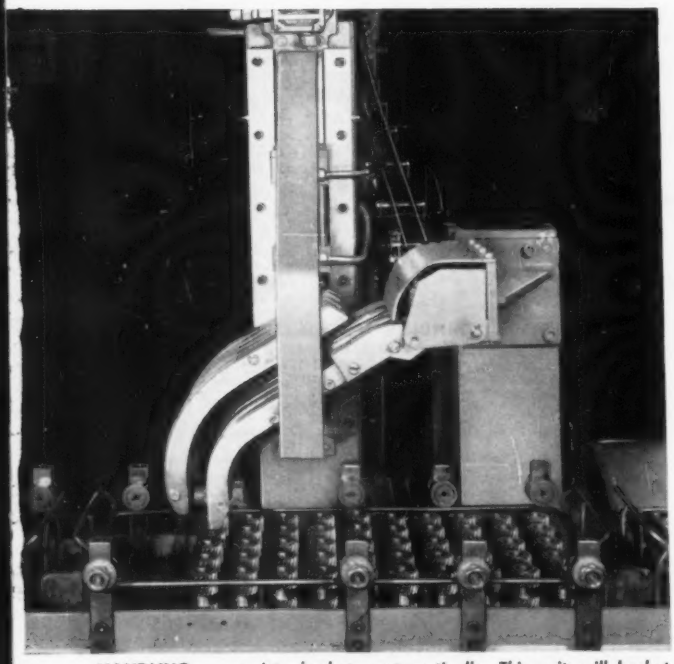


STORING—3000 parts or feeding 5000 parts an hour. Details on G-O-M's newest storage unit available in Bulletin 571. Write for it.



LOADING—and unloading of machine tools is easy with G-O-M's pre-engineered devices. Ask for information on application to your parts.

New automatic handling units to cut costs!



HANDLING—even into baskets, automatically. This unit will basket load 3000 parts an hour for conveyor transfer. Send for Bulletin 568.

Now, more than ever, Gear-O-Mation makes it easy for you to solve the costly problems of process parts handling. How? With functionally designed, readily adaptable equipment to move parts into, through or from various operations—automatically and with full control. The parts? All kinds. Gear-O-Mation has worked with parts from small blanks to heavy castings. Gear-O-Mation's extensive standard line is pre-engineered for simple modification that "tailors" the equipment to your parts.

For automating parts in process, whether to a single machine or a full line, in large or small shops, Gear-O-Mation should be your first call. If your parts require demand control, selective feeding, active storage or positive movement, there's no better source, no better equipment.

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Horsburgh & Scott Co., 5114 Hamilton Ave., Cleveland 14, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

GENERATORS, Electric
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

GRADUATING MACHINES
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.

GREASES—See Lubricating Oils and Greases

GRINDERS, Bench, Floor and Snag
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Carbide Tool
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

GRINDERS, Die and Mold
Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

GRINDERS, Face Mill
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Precise Products Corp., 3751 Blue River Rd., Racine, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio

GRINDERS, Portable Pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.

GRINDERS, Tap
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch Tool Co. Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost
Cosa Corp., 305 Lexington Ave., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

GRINDING MACHINES, Abrasive Belt
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, 8, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Broach
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W. Grand Rapids 2, Mich.
National Broach & Mch. Co. 5600 St. Jean, Detroit 13, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

GRINDING MACHINES, Cam
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

GRINDING MACHINES, Centerless
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

GRINDING MACHINES, Cylindrical

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

GRINDING MACHINES, Disc

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co. 2488-90 River Rd., Cincinnati, Ohio
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

GRINDING MACHINES, Profile

American Laubscher Corp., Fisk Bldg., 250 W. 57 St., New York 19, N. Y.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Surface Reciprocating

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 4, Mich.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDING MACHINES, Surface Rotary

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Walker, O. S. Co., Inc., Worcester, Mass.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Parker-Majestic, Inc., 147 Joseph Campau, Detroit, Mich.

GRINDING WHEEL DRESSING AND FORMING DEVICES

DoAll Co., Des Plaines, Ill.
Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS

Bay State Abrasive Co., Westboro, Mass.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cincinnati Milling Products Div., Cincinnati 9, Ohio
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Metal Carbides Corp., Youngstown, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

HAMMERS, Portable Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HAMMERS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Edlund Mchry. Co. Div., Cortland, N. Y.

(Continued on page 234)

Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

HARDNESS TESTERS

Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.
Wilson Mechanical Instrument Div., 230 Park Ave., New York 17, N. Y.

HEAT-TREATING EQUIPMENT — See Annealing Furnaces, Flame Hardening Machines, Induction-Heating Equipment

HOBS

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio
National Twist Drill & Tool Co., Rochester, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HOISTS, Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HONING MACHINES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Jes-Cal Co., Fraser, Michigan
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.

HONING STONES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Jes-Cal Co., Fraser, Michigan
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HOSE

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

HYDRAULIC MACHINERY
Tools and equipment

Baldwin-Lima Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

INDEXING and SPACING EQUIPMENT

Austin Industrial Corp., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Sundstrand Mch. Tool C., 2531 11th St., Rockford, Ill.
Vinco Corp., 9111 Schaefer Highway, Detroit, Mich.

INDICATOR BASES, Magnetic

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, L. S. Co., Athol, Mass.

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Saginaw, Mich.
National Automatic Tool Co., S. 7th - N. Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. I.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test

Brown & Sharpe Mfg. Co., Providence, R. I.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The, L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

INTENSIFIERS, Hydraulic

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

JACKS, Planer—See Set-up Equipment

JIG BORERS
American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

JIG and FIXTURE PARTS
Northwestern Tool & Eng. Co., 117 Hollier Ave., Dayton 3, Ohio

JIGS AND FIXTURES
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Metal Carbides Corp., Youngstown 12, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

KEYSEATERS
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Bliss, E. W. Co., Canton, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.

KNURLING TOOLS
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

LAPPING MACHINES
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Do-All Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

LATHE ATTACHMENTS
Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.

LATHES, AUTOMATIC—See Chucking Machines

LATHES, Axle
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench
Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Levin, Louis & Son, Los Angeles 21, Calif.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

LATHES, Car Wheel
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Copying, Duplicating — See Lathes, Duplicating

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

LATHES, Duplicating

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio

LATHES, Engine, Manufacturing

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

LATHES, Engine, Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
Leblond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Logan Enginering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

LATHES, Gap

Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

LATHES, Hollow Spindle
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Roll
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton Ohio
Bliss, E. W., Co., Canton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

LATHES, Speed, Second-operation
Atlas Press Co., Kalamazoo, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., Cincinnati 25, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic
Atlas Press Co., Kalamazoo, Mich.
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type
Atlas Press Co., Kalamazoo, Mich.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Levin & Son, Inc., Louis, Los Angeles 8, Calif.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett, L. S., Co., Athol, Mass.
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LEVELS
Lufkin Rule Co., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.

LIMIT SWITCHES—See Switches, Limit

LUBRICATING OILS and GREASES
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave. Chicago 23, Ill.
Madison-Kipp Corp., Madison, Wis.

MACHINERY, Used and Rebuilt
Eastern Mchry. Co., 1000 Tennessee Ave., Cincinnati, Ohio
Miles Mchry Co., 2025 E. Genesee Ave., Saginaw, Mich
Van Keuren Co., Watertown 72, Mass.

MACHINISTS' SMALL TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, The L. S., Co., Athol, Mass.

MANDRELS—See Arbors and Mandrels

MARKING MACHINES and DEVICES
Gorton Mch. Co., 1321 Racine St., Racine Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

MEASURING MACHINES
Lufkin Rule Co., Saginaw, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Keuren Co., Watertown 72, Mass.

MEASURING WIRES—Thread, Spline, Gear
Sheffield Corp., Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown 72, Mass

MICROMETER HEADS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth
Brown & Sharpe Mfg. Co., 235 Promenade St Providence 1, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROSCOPES, Toolmakers'
Bausch & Lomb Optical Co., Rochester, N. Y.
DoAll Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING MACHINE ATTACHMENTS
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches, Inc., 4701 Marburg Ave., Cincinnati 9 Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14 Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.

MILLING MACHINES, Automatic
Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Nichols, W. H. Co., Waltham 54, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

MILLING MACHINES, Bed Type, Simplex, Duplex
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Wrks., Front St. and Girard Ave., Philadelphia, Pa.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

MILLING MACHINES, Bench, Hand

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Nichols, W. H. Co., Waltham 54, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

Arrow Engineering Co., 120 E. Market St., Indianapolis, Ind.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Colonial-Romulus Div., Parkgrove Station, Detroit 5, Mich.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St. Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., 42 Exchange Place, Jersey City, N. J.

MILLING MACHINES, Knee Type Ram

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

MILLING MACHINES, Knee Type Turret

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport, 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R.R., Evanston, Cincinnati, Ohio
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Spar

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cincinnati Milling & Grinding Mches. Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Kearney & Trecher Corp., 6784 W. National, Milwaukee, 14, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

(*Continued on page 240*)

MOLDING MACHINES, Plastic
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

MOTORS, Air
Ingersoll-Rand Co., Phillipsburg, N. J.

MOTORS, Electric
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Lincoln Electric Co., Cleveland 17, Ohio
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

MOTORS, Hydraulic
Barnes, J. S., Corp., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St.; Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

MULTIPLE-STATION MACHINES, Dial Type
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
National Automatic Tool Co., S. 7th N. St. Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

MULTIPLE-STATION MACHINES, Transfer Type
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
La Salle Tool Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch., Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9399 S. Kenwood Ave., Chicago 19, Ill.

NIBBLING MACHINES
Wales-Strippit Corp., Akron, N. Y.

NUT SETTERS—See Screwdrivers, etc.

NUTS—See Bolts, Nuts and Screws

OIL GROOVERS
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OILERS AND LUBRICATORS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

OILS, CUTTING SOLUBLE—See Cutting and Grinding Fluids

OILS, Lubricating—See Lubricating Oils and Greases

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Il.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

OPTICAL FLATS
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., Watertown 72, Mass.

PACKING, Leather, Metal, Rubber Asbestos, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

(Continued on page 242)

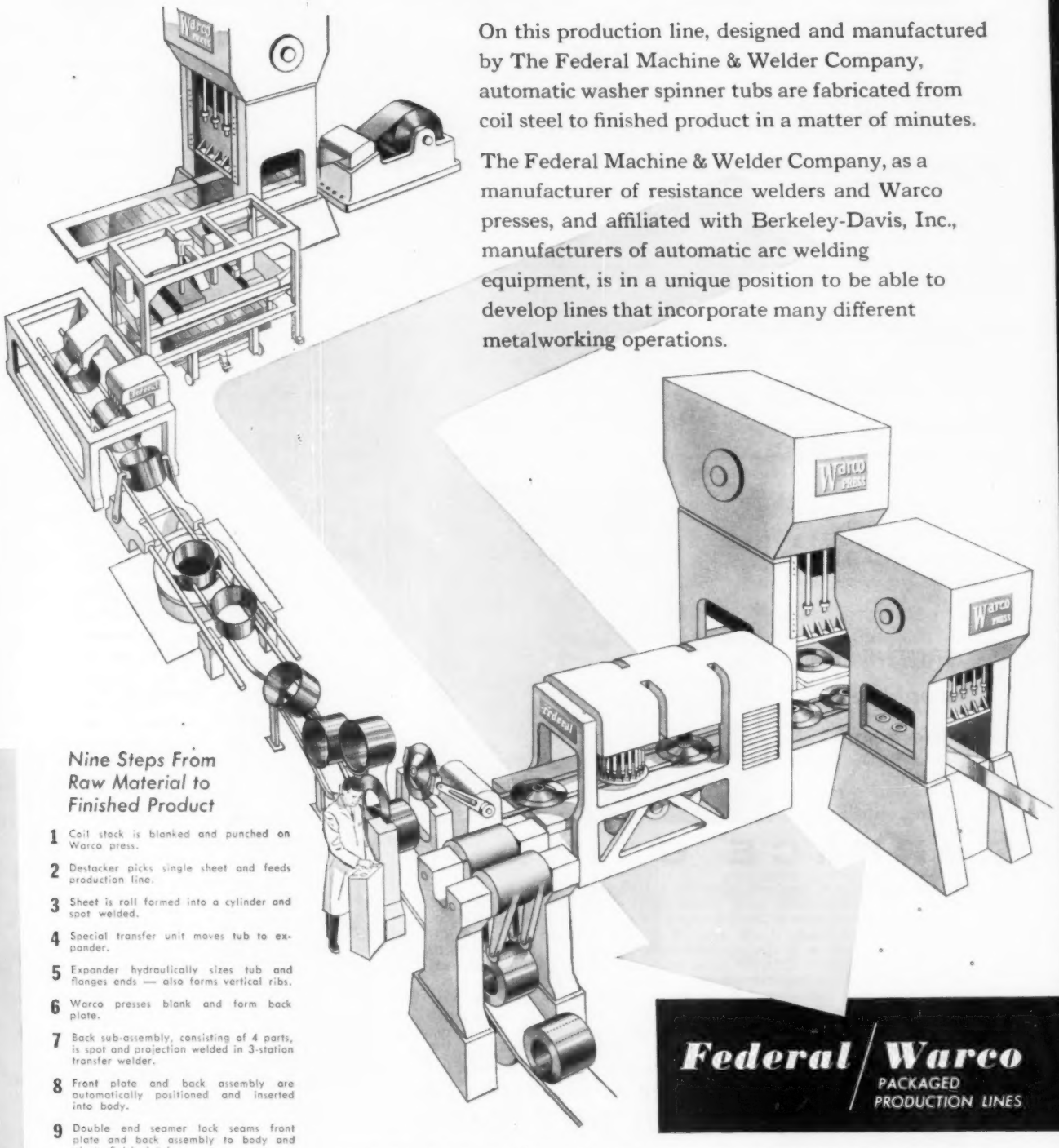
For more information fill in page number on Inquiry Card, on page 161

THE ACCENT IS ON PRODUCTION

in a production line by FEDERAL

On this production line, designed and manufactured by The Federal Machine & Welder Company, automatic washer spinner tubs are fabricated from coil steel to finished product in a matter of minutes.

The Federal Machine & Welder Company, as a manufacturer of resistance welders and Warco presses, and affiliated with Berkeley-Davis, Inc., manufacturers of automatic arc welding equipment, is in a unique position to be able to develop lines that incorporate many different metalworking operations.



Nine Steps From Raw Material to Finished Product

1. Coil stock is blanked and punched on Warco press.
2. Destacker picks single sheet and feeds production line.
3. Sheet is roll formed into a cylinder and spot welded.
4. Special transfer unit moves tub to expander.
5. Expander hydraulically sizes tub and flanges ends — also forms vertical ribs.
6. Warco presses blank and form back plate.
7. Back sub-assembly, consisting of 4 parts, is spot and projection welded in 3-station transfer welder.
8. Front plate and back assembly are automatically positioned and inserted into body.
9. Double end seamer lock seams front plate and back assembly to body and ejects finished tub.

* Sequence of operations controlled by static relay system designed and built by Federal.

Federal / Warco
PACKAGED PRODUCTION LINES

THE FEDERAL MACHINE AND WELDER COMPANY, WARREN, OHIO
Affiliated with Berkeley-Davis, Inc., Danville, Illinois

PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PIPE, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co. (Tubular Prod. Div.), Beaver Falls, Penna.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE AND TUBING MILLS, Electric-weld

Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.

PIPE THREADING AND CUTTING MACHINES

Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Landis Machine Co., Inc., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

PLANER JACKS—See Set-up Equipment

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton Ohio
Consolidated Mch. Tool Div., Rochester, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., 3611 Woodburn Ave., Cincinnati, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLASTICS AND PLASTIC PRODUCTS

Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Gisholt Mch. Co., Madison, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

PRESS BRAKES—See Brakes, Press and Bending

PRESS FEEDER, Automatic

Bliss E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Nilson, A. H. Machine Co., Bridgeport, Conn.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., 255 N. 18th St., Ampere, East Orange, N. J.

PRESSES, Arbor

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Dake Corp., 604 Monroe St., Grand Haven Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha Wis.
Logansport Machine Co., Inc., Logansport, Ind.
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.
Wilson K. R., Inc., Arcade, N. Y.

PRESSES, Assembling

Alva Allen Industries, Clinton, Missouri
Bliss E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Blanking, Stamping

Alva Allen Industries, Clinton, Missouri
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E. Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 N. 8th St., Ampere, East Orange, N. J.
V. & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Walsh Press & Die Co., 4709 W. Kinzie St., Chicago 44, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Briquetting

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Closed-Die Forging

Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

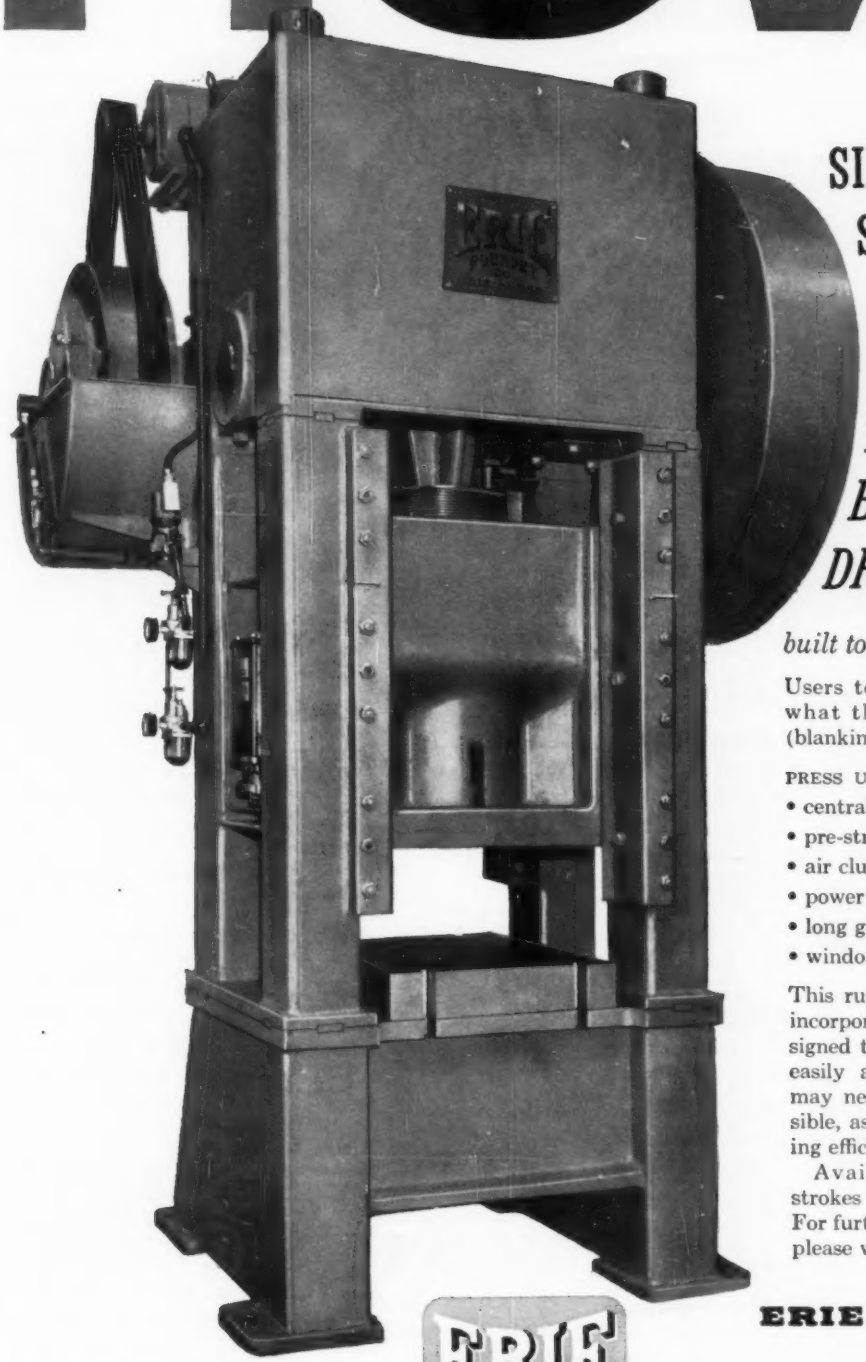
PRESSES, Coining, Embossing

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E. Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.

(Continued on page 244)

new

FROM ERIE FOUNDRY CO.



SINGLE POINT, STRAIGHT SIDE PRESS for *TRIMMING BLANKING DRAWING*

built to J. I. C. standards

Users told Erie Foundry engineers what they wanted in a trimming (blanking and drawing, too) press.

PRESS USERS ASKED FOR:

- central forced lubrication
- pre-stressed strain rods for rigidity
- air clutch and brake
- power ram adjustment
- long guide faces, easily adjusted
- windows in the side housing

This rugged new Erie Foundry press incorporates all these features so designed that maintenance may be done easily and quickly. All parts which may need servicing are readily accessible, assuring maximum press operating efficiency.

Available in various speeds and strokes in sizes from 150 to 600 tons. For further information, or quotations, please write.

ERIE FOUNDRY CO.
ERIE 5, PA.

ERIE

World's greatest name in forging machinery since 1895

For more information fill in page number on Inquiry Card, on page 161

Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R. Arcade, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Die Sinking (Hobbing)

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Die Tryout

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Drawing

Alva Allen Industries, Clinton, Missouri
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6399 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilsen, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc. Arcade, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Foot

Famco Machine Co., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Notching

Alva Allen Industries, Clinton, Missouri
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit Corp., Akron, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Punching, Piercing

Alva Allen Industries, Clinton, Missouri
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha, Wis.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood, Chicago 19, Ill.
Wales-Strippit Co., Akron, N. Y.
Walsh Press & Die Co., 4709 W. Kinzie St., Chicago 44, Ill.
Wiedemann Machine Co., Gulph Rd., King of Prussia, Penna.
Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Quenching

Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Rubber-Forming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Trimming

Alva Allen Industries, Clinton, Missouri
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PROFILING MACHINES—See Milling Machines, Die Sinking, etc.

PROTECTORS, Thread & Tube

Maybrun, A. E. Co., 920 Ripley St., Santa Rosa, Calif.

PULLEYS

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

PUMPS, Coolant and Lubricant

Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Graymills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 2, Ohio
Viking Pump Co., Cedar Falls, Iowa

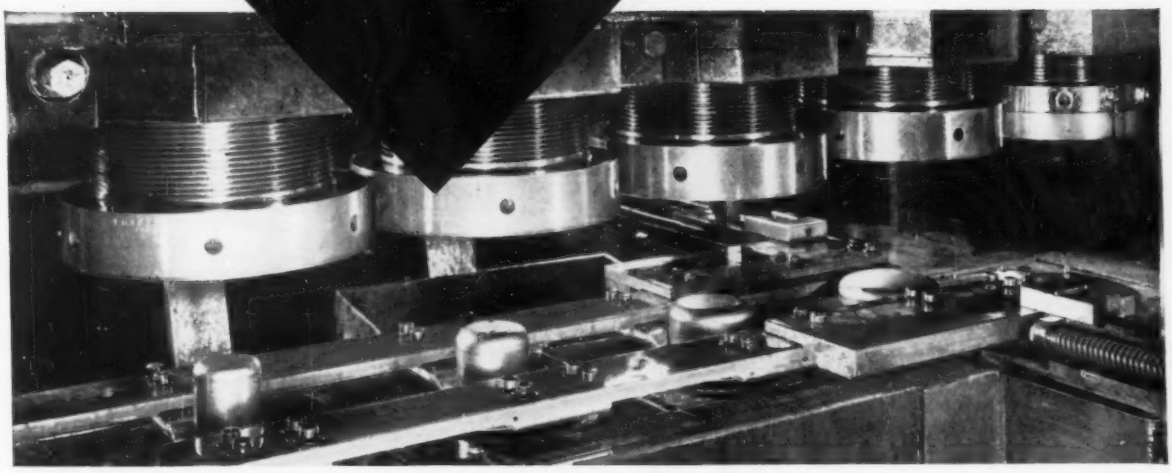
PUMPS, Hydraulic

American Engineering Co., Wheatsheaf Lane & Sepviva St., Philadelphia 37, Penna.
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa
Wilson, K. R., Inc., Arcade, N. Y.

(*Continued on page 246*)

MEL-TROL

at work



To deliver uniform performance between grinds, a drawing or blanking die has to be hard and tough through its whole thickness.

And no matter how well it is designed and heat treated, it can only be as uniform through the center as the bar you make it from . . . and the bar can only be as uniform as the ingot from which it is rolled.

That's why, when you make a die from Carpenter MEL-TROL air hardening die steels—such as No. 484 and No. 610—you *know* you're going to get predictable performance. The high quality of MEL-TROL die steels is guarded by a system of the most advanced and accurate quality controls ever used in steel making.

And an exclusive Carpenter-patented mold produces ingots with greater uniformity through the center than any others made on a production basis today.

Why don't you try Carpenter MEL-TROL quality tool and die steels? Call your Carpenter representative and place your order today.

Carpenter STEEL

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.
Webb Wire Division, New Brunswick, N. J.

PUNCHES AND DIES—See Dies, Blanking, etc.

REAMERS, Rose, Chucking, Jobbers Taper, Shell, Adjustable, etc.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

REELS, Stock
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

REFRACTORS Heat-Treating Furnaces
Norton Co., 1 New Bond St., Worcester 6, Mass.

RETAINING RINGS FOR BEARINGS, etc.
Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.

RIVETERS, Portable
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

RIVETERS, Stationary
Brown & Sharpe Mfg. Co., 35 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

ROTARY TABLES, Optical
Machine Products Corp., 6771 E. McNichols Rd., Detroit 12, Michigan

RULES, SCALES AND STRAIGHTEDGES
See Machinists' Small Tools

RUST INHIBITORS
Kasenit Co., Mahwah, N. J.
Oakite Products, Inc., 26 Rector St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

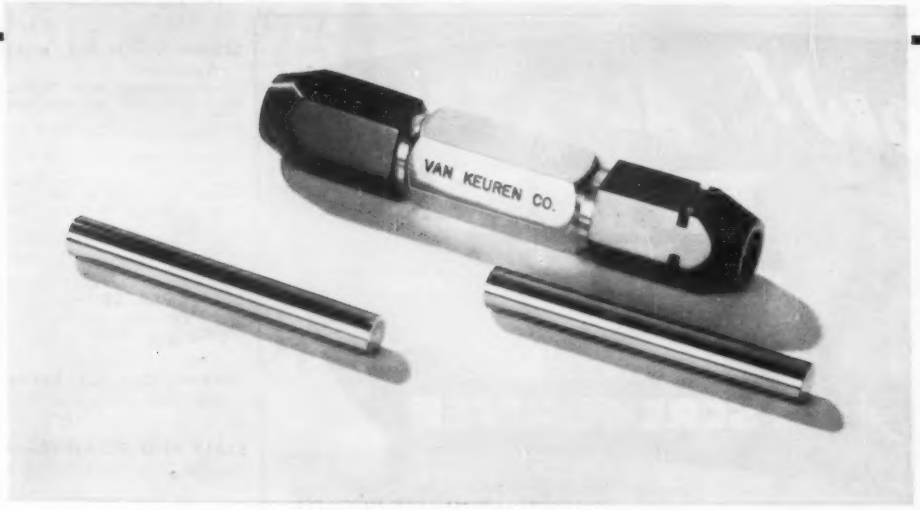
SAW BLADES, Hack, Band, Circular Friction
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Capewell Mfg. Co., 60 Governor St., Hartford, Conn.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Mach. Works, Philadelphia, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Tannewitz Works, Grand Rapids, Mich.

SAW BLADE SHARPENERS
DoAll Co., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.

(*Continued on page 248*)

IMMEDIATE DELIVERY

Van Keuren Wire Type Plug Gages



WIRE TYPE (REVERSIBLE) PLUG GAGES were originated by **THE VAN KEUREN CO.** in 1923, and since that time have been supplied to an ever expanding group of manufacturing concerns throughout the country and abroad. The wire type design has enjoyed tremendous popularity because of the inherent economy represented by the fact that the gage units can be reversed, or cut off, to obtain substantial increase in gage life.

As a result of our long experience in developing and pioneering the manufacture of wire type plug gages and the sale of millions of these units, we have come to know what sizes will be required during a given period of time, and have prepared ourselves by finishing in advance a multitude of units which are in constant readiness for shipment. Our methods of size prediction through research and sales analysis have been successful to the point that there is now better than a four out of five chance that at any time we will have on hand the gage or gages that you need. In addition improved and highly efficient methods of manufacture developed during the years of our work in this field make possible the manufacture, to your requirement, of any size not on hand, in an incredibly short time.

VAN KEUREN WIRE TYPE PLUG GAGES are made to the most exacting requirements as to diameter, roundness, hardness, stability and surface finish. They are offered in all tolerances from XXX (.00001") to ZZ, and are available as units, in handles, or in sets.

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

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39th YEAR

THE Van Keuren CO.,

178 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Carbide Pivots . . . Precision Lapping Service.

For more information fill in page number on Inquiry Card, on page 161

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

SAWING MACHINES, Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Cutron Mfg. Co., Lubbock, Texas
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., Kenosha, Wis.
Tannewitz Works, Grand Rapids, Mich.

SAWING MACHINES, Circular Blade

Consolidated Mch. Tool Div., Blossom Road Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

SAWS, Screw-slotting—See Cutters, Milling

SCREW DRIVERS, STUD AND NUT SETTERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Air Tools, P. O. Box 2119, Houston, Texas
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

SCREW MACHINES, Hand—See Lathes, Turrett, Ram-type, Saddle-type

SCREW MACHINES, Single-Spindle Automatic

Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain- Gridley Mch. Div., New Britain, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

SCREW MACHINES, Multiple-Spindle Automatic

Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 31st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St. New York 12, N. Y.
Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

SCREW PLATES

Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

SCREWS, Cap, Set, Self-tapping, etc.—See Bolts, Nuts and Screws

SEALS AND RETAINERS—Oil or Grease

Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

SEPARATORS, Magnetic

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

SET-UP EQUIPMENT

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Lufkin Rule Co., Saginaw, Mich.
Northwestern Tool & Eng. Co., 117 Hollier Ave., Dayton 3, Ohio
Starrett, The L. S., Co., Athol, Mass.

SHAPERS, Crank and Hydraulic

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

SHAPERS, Vertical and Slotters

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHEARS, Alligator

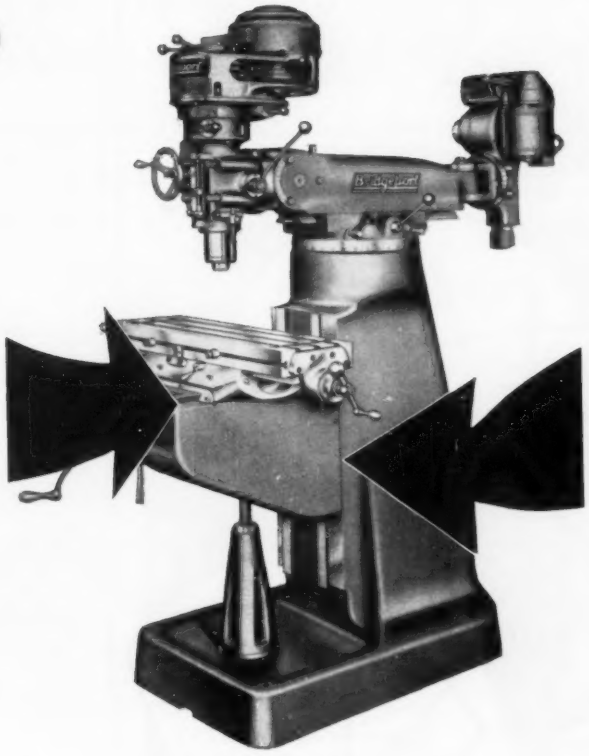
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

(*Continued on page 250*)

Bridgeport

increases Machine Capacity . . .

. . . and can ship to meet your needs



Cross travel increased from 9″ to 12″

Knee-to-column ways lengthened from 15″ to 18″

The NEW Cross Travel Knee

Through a new knee, now available, cross travel is increased on Bridgeport Milling Machines to 12″. Then, too, the knee-to-column ways have been lengthened from 15″ to 18″, assuring the maximum in rigidity and alignment.

Where more productivity is needed through greater capacity, these new features available in the "Bridgeport" at only a slight extra cost, will appeal strongly to shopmen everywhere. Toolmakers, moldmakers, pattern makers or production machinists will be well pleased with the greater productivity now made possible.

A NEW Optical Measuring System

A new direct-reading optical system has been developed which will greatly simplify and improve performance of the machine when used for jig boring.

SPECIFICATIONS

Longitudinal Travel—20″
Cross Travel—9″ or 12″
Magnification—17 times
Reading Accuracy: direct—.0001″
Scales—100 lines per inch or 1 every .010
Glass covered scales for permanency
Electrical system—low, safe, 6 volts
Lateral adjustment of instrument—1″
Reading: catch fork system—*direct digit*
Reed Type Clamp System

New 3-Dimensional Hydraulic Tracing Machine

The new 3-dimensional Duplicating Machine received the highest praise at the recent ASTE Tool Show. Cylinders are built into special knee and saddle casting. 12″ cross travel, one-shot lubrication system and chrome-plated ways are standard features on this machine.

WE CAN SHIP TO SUIT YOUR NEEDS WITH OUR EXPANDED PRODUCTION FACILITIES

For long life, hard-plated ways are available on all Bridgeport Milling Machines.

Bridgeport MACHINES, INC.
Bridgeport, Connecticut
Manufacturers of High Speed Milling Attachments and Turret Milling Machines

For more information fill in page number on Inquiry Card, on page 161

SHEARS, Rotary
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

SHEARS, Squaring
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Famco Machine Co., Kenosha, Wis.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

SHIM STOCK
Laminated Shim Co., Inc., Glenbrook, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

SLITTING MACHINES, Rotary
Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

SLOTTERS—See Shapers, Vertical and Slotters

SOCKETS—See Drill Sleeves and Extension Holders

SOLENOIDS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee 4, Wis.
Barnes, John S. Corp., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Vickers, Inc., Detroit 32, Mich.

SPECIAL MACHINERY AND TOOLS
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

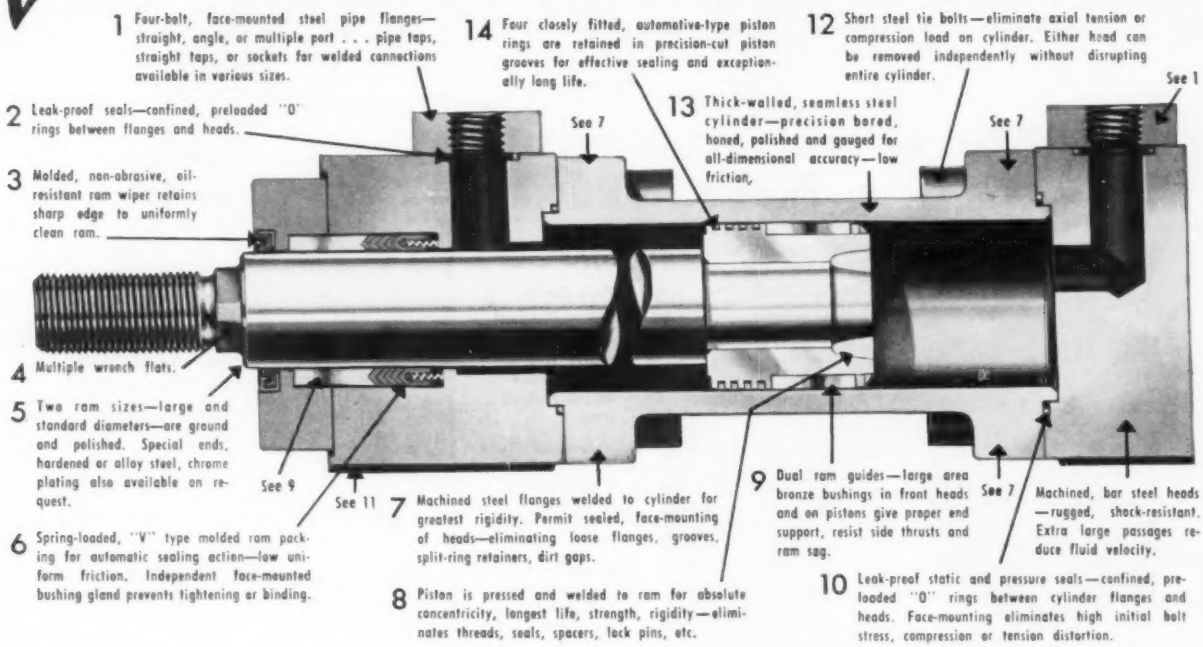
(Continued on page 252)

. . . Fluid Power news

NEW HEAVY DUTY CYLINDERS

NOW AVAILABLE—New Oilgear "Custom-Quality" Line of Heavy-Duty, 3,500 psi Cylinders

✓ Check . . . Compare these 20 "Custom-Quality" features:



15 Adjustable hydraulic cushions—dash pots—for front, rear, or both heads. New, exclusive Oilgear floating-sleeve design assures superior performance, longer life, less wear—eliminates check valves.

16 Eight basic sizes—2", 2½", 3¼", 4", 5", 6", 7", 8" . . . length of stroke varies from 36" to 158". Longer stroke available on request.

17 Air vent plugs, double end rams, special ram ends, special packings for use with fire-resistant fluids are also available.

18 Choice of fixed mountings—foot lug, center lug, or flange—can be combined or interchanged, front or rear, to suit any requirement.

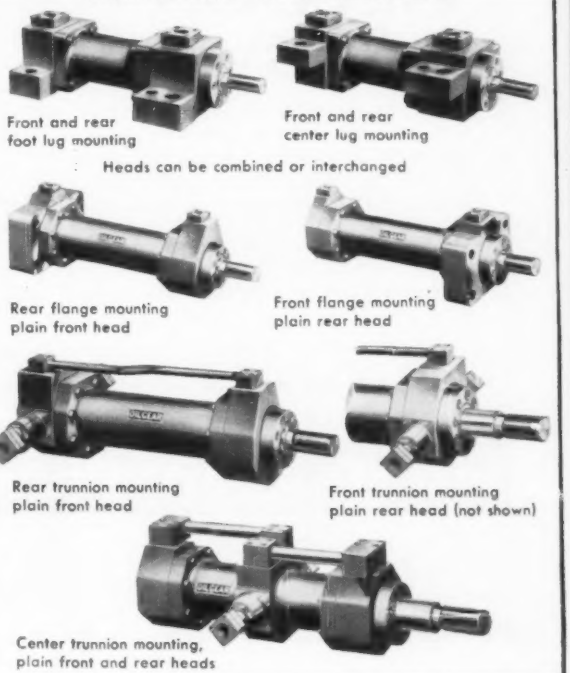
19 Choice of hollow trunnion mountings—rear, center, front—accurately machined, integral with heads. No hoses or slide joints—Oilgear's exclusive steel flange connectors—rugged, leak-proof, rotate smoothly.

20 Designed and built to the highest standard of quality for the most dependable, trouble-free, long life. Machinery builders and users alike, say—"For the lowest cost per year—it's Oilgear!"

Complete user satisfaction is guaranteed by Oilgear's extensive research, testing, over 35 years of design, manufacturing, and application experience in the field of Fluid Power—both oil and fire-resistant fluids.

For further information on these new cylinders, call your Oilgear Application-Engineer. Or write for bulletins 73000 and 73245 directly to . . .

STANDARD MOUNTINGS



THE OILGEAR COMPANY

Application-Engineered Fluid Power Systems

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Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SPEED REDUCERS
Barnes, J. S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
DoAll Co., Des Plaines, Ill.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

SPINDLES, Machine
Bearings, Inc. 3634 Euclid Ave., Cleveland 15, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N. St., Richmond, Ind.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio

SPRAYING EQUIPMENT, Metal
Metallizing Eng. Co., Westbury, L. I., N. Y.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal
Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL ALLOYS—See Alloy Steels

STEEL, Cold Rolled, Stainless, High-speed, Tool, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Penna.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL DISTRIBUTORS
Ryerson, Jos. T., & Son, 16th & Rockwell St., Chicago 8, Ill.

STOCKS AND DIES
DoAll Co., Des Plaines, Ill.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

STRAIGHTENERS, Flat Stock and Wire
Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

STRIP AND SHEET, Ferrous
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Penna.

STRIP AND SHEET, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.

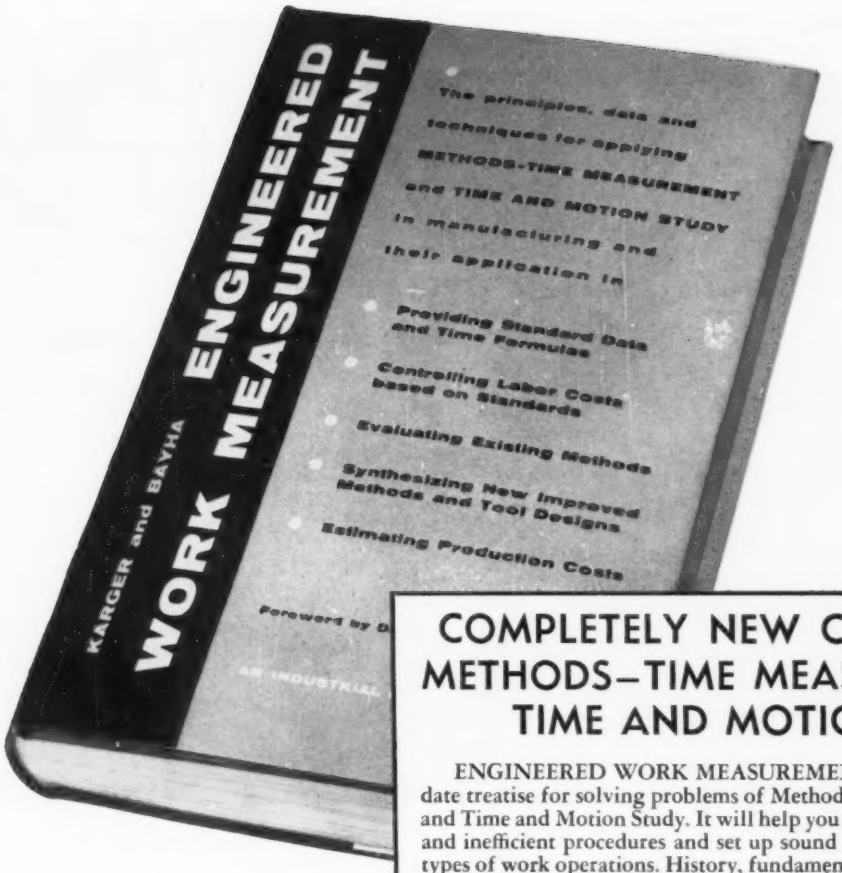
(Continued on page 254)

For more information fill in page number on Inquiry Card, on page 161

Bridgeport Brass Co., Bridgeport, Conn.

TAPS, Collapsing

TOOL MATERIAL, Ceramic



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Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STRUCTURAL SHAPES
Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Pa.

STUD SETTERS—See Screwdrivers, etc.

SUPERFINISHING EQUIPMENT
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.

SWITCHES, Limit
Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.

TACHOMETERS—See Indicators, Speed

TAP HOLDERS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.

TAPPING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

TAPPING MACHINES
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Edlund Machinery Co., Cortland, N. Y.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Kaufman Manufacturing Co., Manitowac, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Landis Mch. Co., Waynesboro, Pa.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

TAPS, Hand, Machine Screw, Pipe, etc.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Sheffield Corp., Box 893, Dayton 1, Ohio

THREAD CUTTING MACHINES
Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Geometric Tool Co. Div., Greenfield Tap & Die Corp., New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
National Machinery Co., Tiffin, Ohio
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
V & O Press Co., Hudson, New York

TIME RECORDERS
Lathem Time Recorder Co., Atlanta 8, Georgia

TOOL CONTROL BOARDS
Cross Co., 3250 Bellevue, Detroit 7, Mich.

TOOL HOLDERS
Apex Tool & Cutter Co., Inc., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio
R & L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL MATERIAL, Cast Non-Ferrous Alloy
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, Cemented Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Cleveland Twist Drill Co., 5214 W. Armstrong, Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Metal Carbides Corp., Youngstown 12, Ohio
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL MATERIAL, Ceramic
Metal Carbides Corp., Youngstown 12, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, High-Speed Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

TRACING ATTACHMENTS
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Atlas Press Co., Kalamazoo, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Wales-Strippit Co., Akron, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

TRANSFER MACHINES, Automatic—See Multiple-Station Machines

TRANSMISSION, Variable Speed
Barnes, John S. Corp., Rockford, Ill.
Boston Gear Wks., Quincy, Mass.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Vickers, Inc., Detroit 32, Mich.

TRUCKS, Material Handling
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio

TUBE-FLANGING MACHINES
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.

TUBE FORMING AND WELDING MACHINES
Yoder Co., 5504 Walworth Ave., Cleveland, Ohio

TUBE MILLS
Yoder Co., 5504 Walworth Ave., Cleveland, Ohio

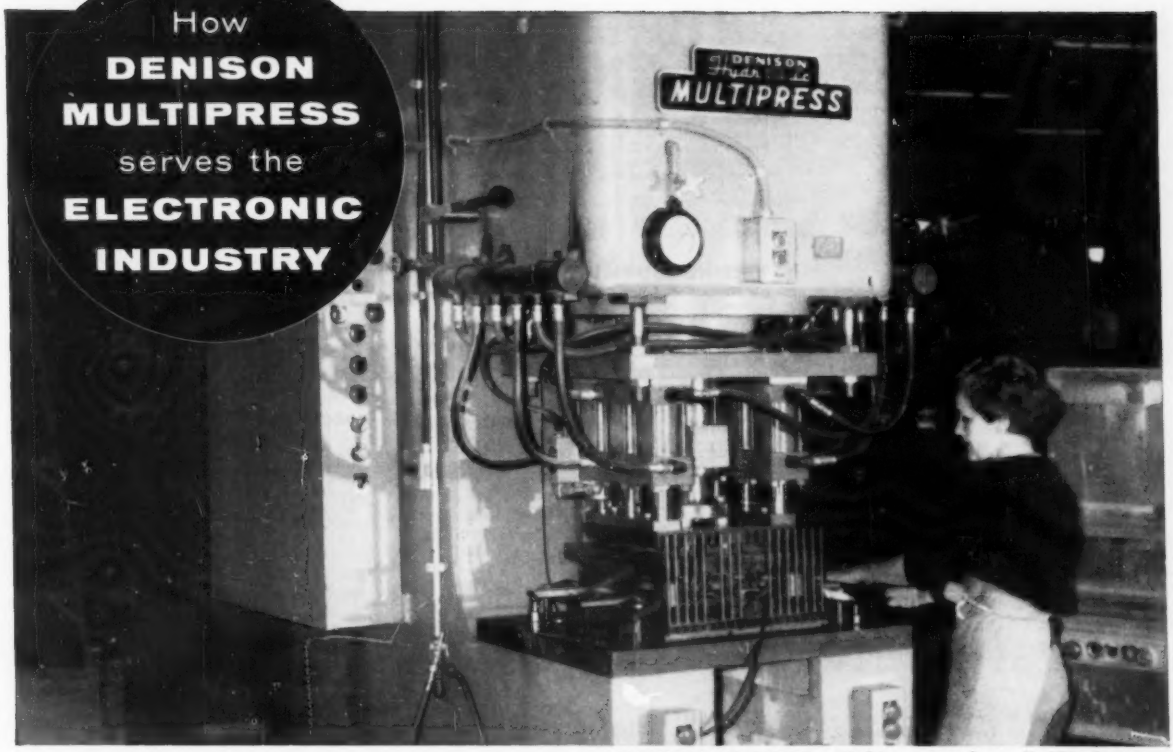
TUBING, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.

TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co., Beaver Falls, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio

TUBE & PIPE CUTTING-OFF MACHINES
Sheffield Corp., Box 893, Dayton 1, Ohio

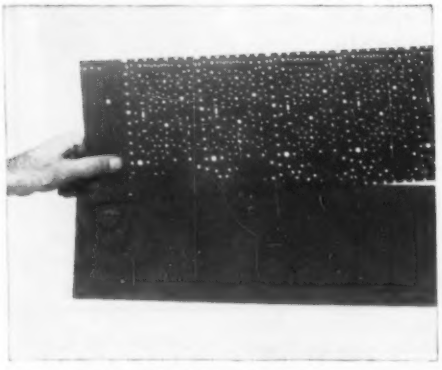
(*Continued on page 256*)

How **DENISON MULTIPRESS** serves the **ELECTRONIC INDUSTRY**



450 HOLES AT A TIME... *Multipress punches radio-TV chassis on this 100-ton Denison hydraulic Multipress at Motorola, Inc., Chicago.*

Precision-punching TV chassis holes faster—450 at a time—at **MOTOROLA** with **DENISON** hydraulic Multipress



RESULTS... *Motorola's plastic chassis bases are punched faster, to precise limits with Denison Multipress.*

At a Motorola plant in Chicago, plated-circuit chassis (designed as a base for radio and TV packaged electronic circuits) are precision-punched faster on a 100-ton Denison hydraulic Multipress.

With one quick, controlled ram stroke, Multipress *punches up to 450 holes at a time* in these plastic chassis boards. And Multipress does the job without shock to exact pre-set pressures... with absolute *control after breakthrough.*

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Endless jobs throughout the electronic and other industries can be done *faster... for less cost* with Denison hydraulic Multipress—from 1 to 100 tons. Ask your Denison production specialist to show you how.

DENISON ENGINEERING DIVISION
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ULTRASONIC MCH. TOOLS
Sheffield Corp., Box 893, Dayton 1, Ohio

VALVE CONTROLS
Barnes, John S., Corp., Rockford, Ill.
Logansport Mch. Co., Inc., Logansport, Ind.
Vickers, Inc., Detroit 32, Mich.

VALVES, Air
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Numatics, Inc., Milford, Mich.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

VALVES, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hunt, C. B., & Son, 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

VERNIERS—See Calipers, Vernier; Gages, Vernier

VISES, Machine
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave. Pittsburgh, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Hts. Blvd., Detroit 20, Mich.

WELDING EQUIPMENT, Arc
Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Gas
Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Resistance
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Federal Mch. & Welder Co., Warren, Ohio

WELDING POSITIONERS
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.

WELDMENTS
Bliss, E. W. Co., Canton, Ohio
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

WIPERS
Scott Paper Co., Chester, Pa.

WIRE
Allegheny Ludlum Steel Corp., Pittsburgh, Pa. (Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Penna.

WIRE FORMING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc. 255 North 18th St., Ampere, E. Orange, N. J.

WOODWORKING MACHINES
Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave. Pittsburgh, Pa.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.

WRENCHES, Allen, End, Socket, Adjustable, etc.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

WRENCHES, Power Chuck
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.

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PLAIN CYLINDRICAL GRINDERS

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No. 20—10x18" cap. Brown & Sharpe Plain Cylindrical, m.d.
4x12" Landis Type H Knee Hole Type, m.d.
5x18" Ott Plain Cylindrical, m.d.
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6x18" Cincinnati Model EA, m.d.
6x18" Landis Type C Hydraulic, m.d., late
6x18" Norton Plain Grinder, m.d.
10x18" Cincinnati Plain Hydraulic, Model ER, m.d., Filmatic Spindle, 1943
10x18" Cincinnati Model EA, m.d.
10x18" Norton Type C, m.d., latest
10x36" Cincinnati Hydraulic, m.d.
10x36" Norton Type C, m.d.
10x36" Landis Type CH Plain, m.d.
10x48" Cincinnati Model ER Plain Hydraulic, m.d.
12x36" Landis Plain Self-Contained, m.d.
14x36" Landis Type C, 1945
16x72" centers Type C Norton Semi-Auto., Hydraulic
16x96" Cincinnati Plain Cylindrical, m.d.
16"x40"x120" Cincinnati Plain Heavy Duty, 1953
16"x120" Landis Type B Plain H.D., Hydraulic, m.d., late
18"x36" Landis Type C, m.d.
18"x72" Norton Type C, mechanical, m.d.
25"x72" Landis Type C, m.d.

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7½ H.P. United States Elec. Tool Co. Double End, Model 80, new
Type No. 50—7½ H.P. Standard Elec. Tool Co. Double End
25 H.P. U.S. Elec. Co., Heavy Duty Double End, m.d.

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No. 16A-2 Blanchard Auto. Rotary, m.d.
No. 33 Abrasive, m.d.
14" Pratt & Whitney Vertical, m.d.
14" Pratt & Whitney Model M1640 Vertical, m.d.
No. A-1-8" Arter Surface Grinder
No. 22—12" Heald Rotary, m.d.
No. 25-A-24" Heald Rotary, m.d.
No. 2 Brown & Sharpe, m.d.
#300-60 Hanchett Vertical Spindle, m.d.
16" wide, 24" under wheel, 120" table Mattison, m.d.
Model F, 6x10x18" Thompson Hydraulic Horizontal Wheel, m.d.
Model 8-A-61" Bridgeport Hydraulic Face, m.d.
Schonherr Way Grinder, radial arm
14"x16"x48" Thompson Type C Horizontal, m.d.

THREAD GRINDERS

No. 33 Excello Precision, m.d.

TOOL & CUTTER GRINDERS

Pratt & Whitney Deep Hole Drill Sharpener, m.d.
No. 1 Heald Tool Sharpener, m.d.
No. 2A Wm. Sellers Universal Tool Grinder, m.d.
No. 2B Sellers Wet Drill Grinder, m.d.
No. 4T Sellers Tool, m.d., latest
No. 5T Sellers, m.d.
No. 6G Sellers, m.d.
12" Gleason Spiral Bevel, Gear Cutter Sharpener, m.d.
No. 13 Gleason Cutter Sharpener, m.d., late
Ingersoll Face Mill Grinder
No. 13 Brown & Sharpe Universal, m.d.
No. 4-4 Barber-Colman Hob Sharpener, m.d.
Sundstrand Tool Grinder, m.d.

HONE MACHINES

No. 3 Barnes Single Spindle Internal Hone, new
No. 182 Barnesdrill, m.d.
No. 854 Micromatic Vertical Honing Machine, m.d.
H1 Micromatic Horizontal Hydrohoner, m.d.
H4 Micromatic Horizontal Hydrohoner, m.d.
No. 6 Barnes Twin Spindle
No. 306H Barnes Twin Spindle
No. 224B Barnes Honing Machine, m.d.
Model MA Sunnen Bench Type, m.d.
Model 4014C Barnes Self-Oiling Hydraulic Vertical

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Morton, m.d., thru reversing gear box
Taylor & Fenn Horizontal Shaving, Shaping Keyseating, m.d., 1942
W-L-W Machine Keyseater, new

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12"x40" centers American, m.d.
12½"x42" Cincinnati Tray Top Model LE, new
13"x48" centers Sheldon, m.d., 1956
13"x42" centers LeBlond "Regal", m.d.
13"x48" centers Pratt & Whitney, m.d.
14"x30" centers Lodge & Shipley, m.d.
14"x11¾" centers Lodge & Shipley, m.d.
14"x32¾" centers Springfield, m.d., taper
14"x33" centers Sidney, m.d.
14"x33¼" centers Lodge & Shipley, m.d.
14"x36" centers LeBlond Geared Head, s.p.d.
14"x36" centers Monarch, motorized, cone
14"x36" centers Pratt & Whitney, cone
14"x54" centers Reed Prentice Geared Head, m.d., late
14"54" centers LeBlond Regal, m.d.
16"x28¾" centers Hendey Yoke Head, m.d., taper
16"x29½" centers Lodge & Shipley Selective Head, m.d.
16"x29½" centers Monarch Geared Head, m.d.
16"x30" centers American High Duty, m.d.
16"x30" centers Monarch, m.d., taper
16"x30" centers Monarch, Model CW, m.d
16"x30" centers Hendey Geared Head, m.d.
16"x30" centers Reed Prentice, m.d.
16"x102" centers American High Duty, m.d.
16"x55½" centers Monarch, m.d.
18"x30" centers American, m.d., S speed
18"x39" centers Greaves-Klusman, m.d.
18"x48" centers Lodge & Shipley, m.d
18"x49" centers Lodge & Shipley, m.d.
18"x51" centers American Geared Head, m.d.
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DRILL, UPRIGHT. 24" Cincinnati Bickford, tapping, No. 4 MT
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GRINDERS, CYL. 14" x 14" Model 112 Rivett Univ., 1942
GRINDERS, CYL. 20" x 72" Landis, Type D, Hyd., 1943
GRINDER, INT. 7245 Heald, Univ., Hydr.
GRINDER, INT. No. 74 Heald Hydr., plain, 1941
GRINDER, INT. No. 75A Heald hand feed, 1941
GRINDER, SURF. 14" x 48" Mattison, Hydr., 1942
GRINDER, SURF. 20" & 24" No. 25A Heald, rotary
GRINDER, SURF. 36" No. 18 Blanchard, 1940
GRINDER, CUTTER. 30" Ingersoll, 1942
GRINDER, CARBIDE. Nos. 48 and 49 Excello, 1941
GRINDER, RADIUS. No. 49 VanNorman, late
HOB SHARPENER. Type HRS Barber Colman
KELLER. BL2416 Prat & Whitney 3 Spdl., 1941
LATHE, ENGINE. 11" & 14" South Bend, late
LATHES, ENGINE. 13", 15" & 17" LeBlond Regals, new
MILLER, HAND. No. 2RV Kent-Owens, 1942
MILLERS. No. 10 & 3 VanNorman Duplex
MILLER, UNIVERSAL. No. 2H Kerney & Trecker, H.S.D.T.
MLLER, PLAIN. No. 2 Cincinnati
MILLER, VERTICAL. No. 2 Brown & Sharpe, 1943
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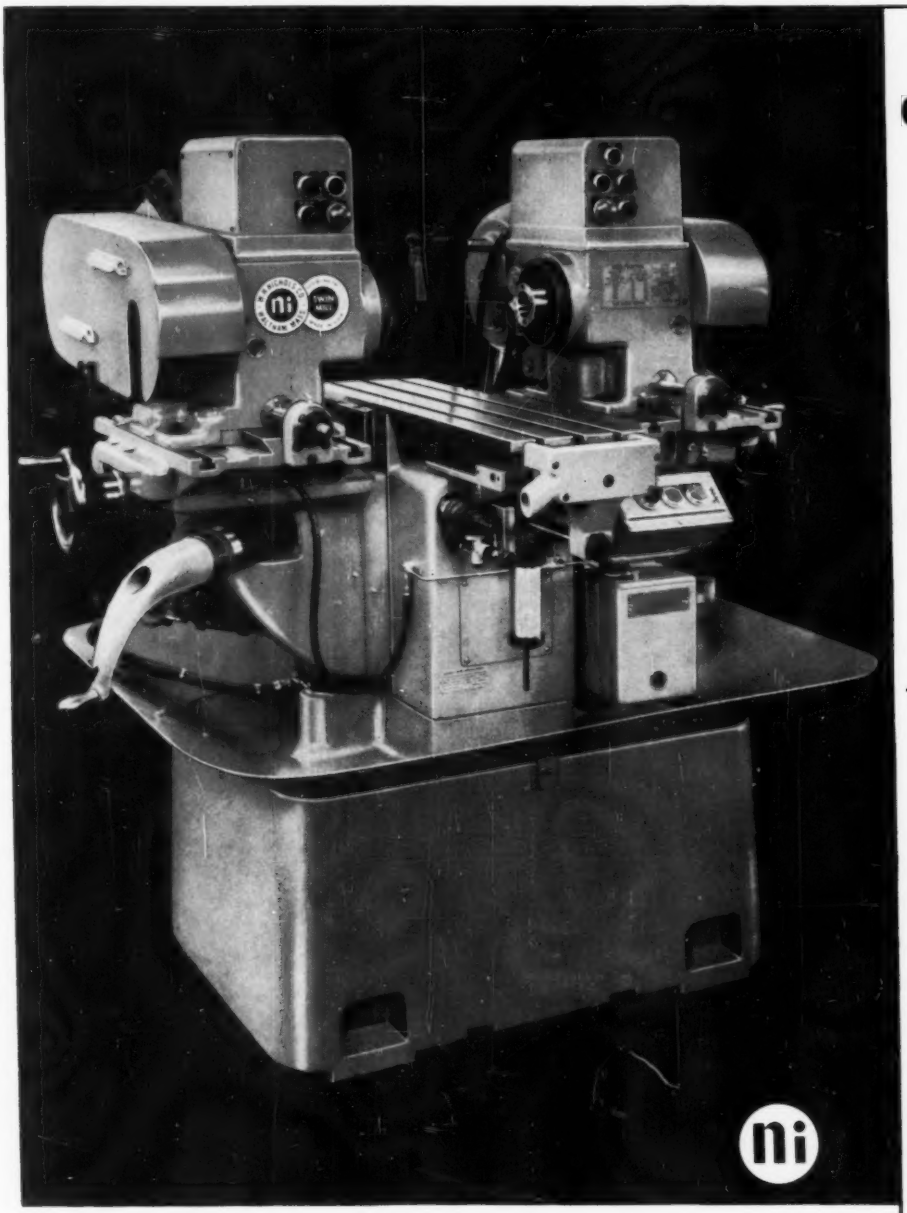

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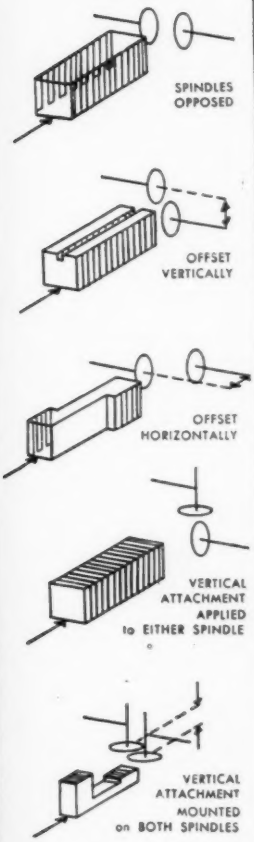

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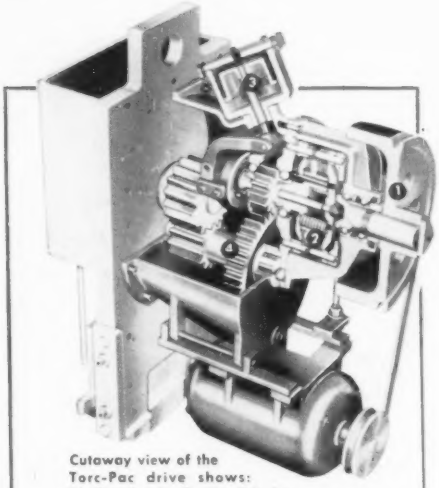

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